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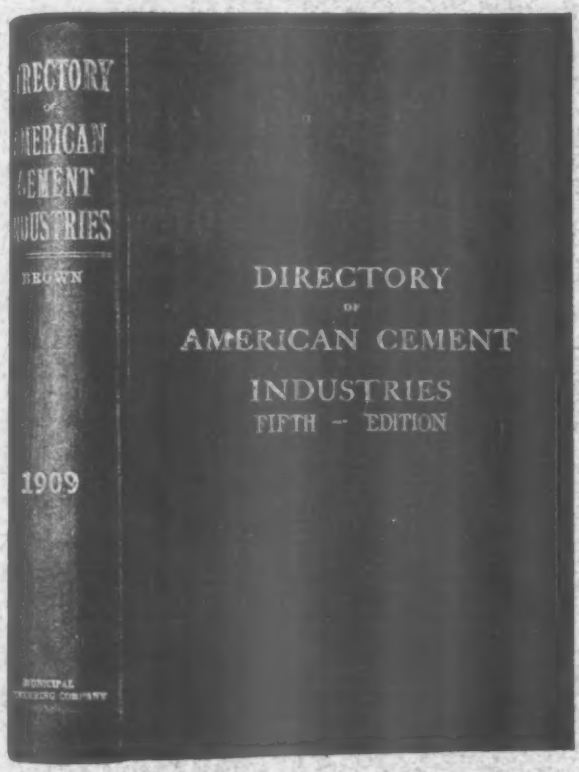

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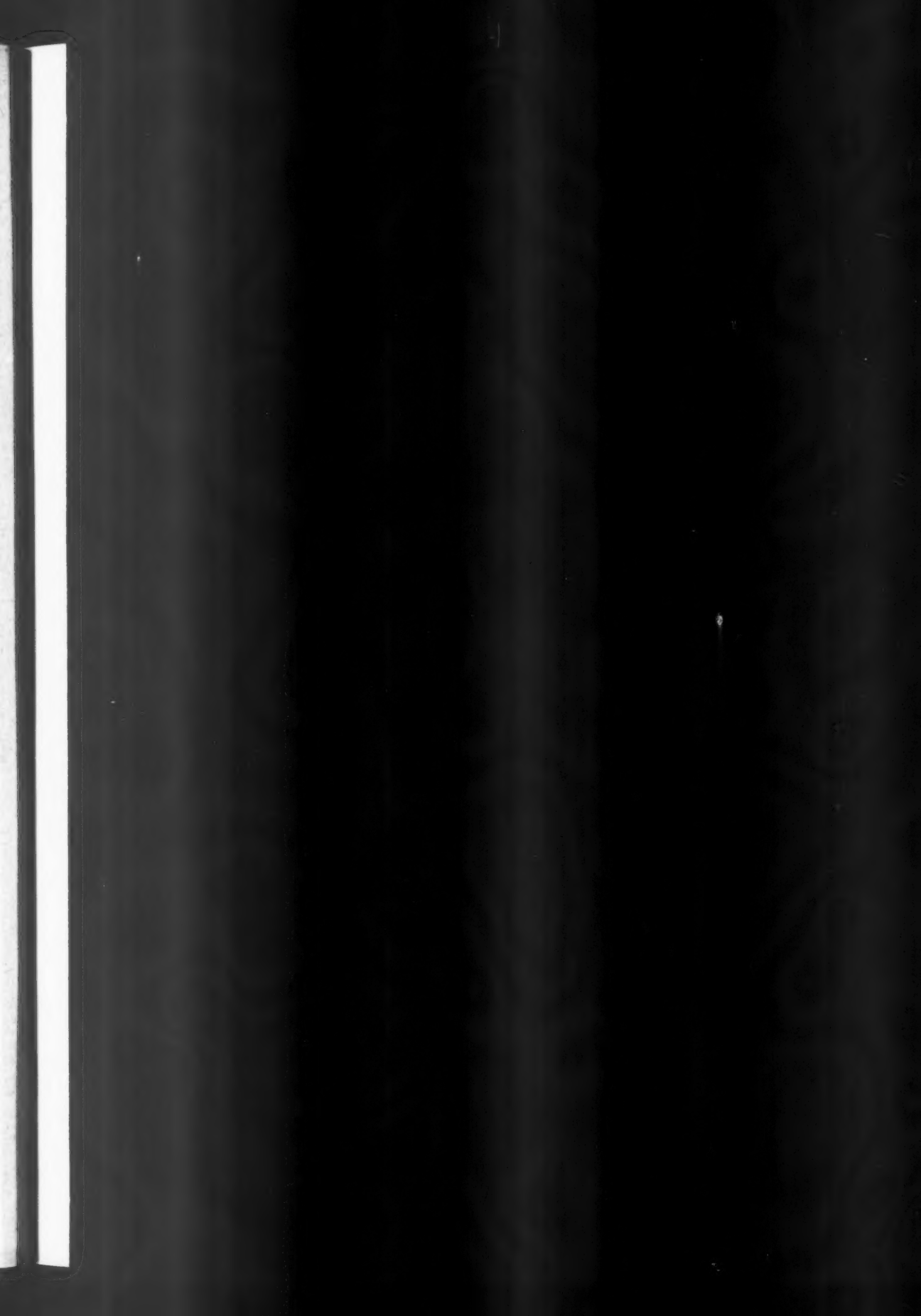

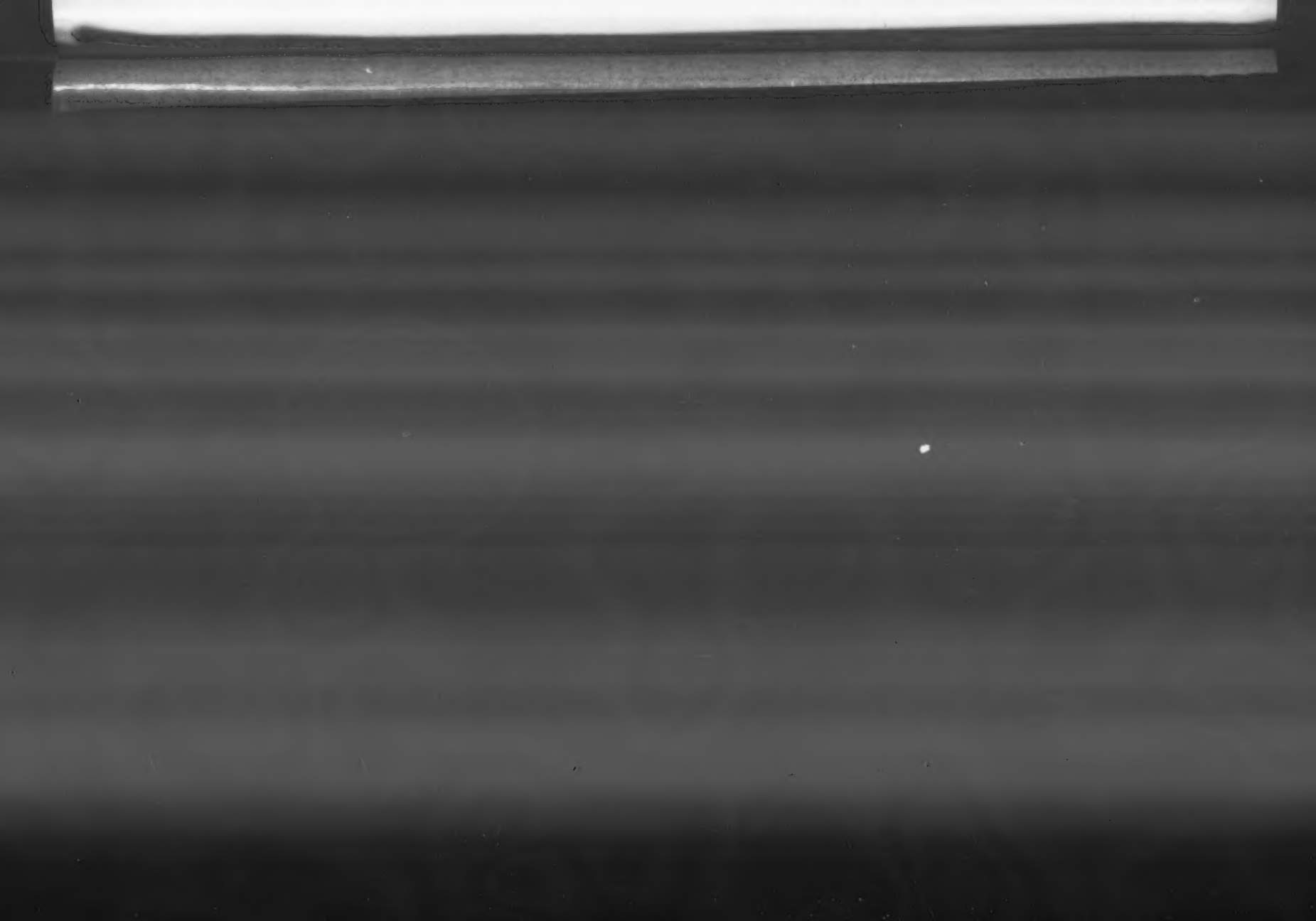

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MUNICIPAL ENGINEERING

VOLUME XXXVII. NOVEMBER, NINETEEN HUNDRED NINE. NUMBER FIVE

TOWN SCAVENGING AND REFUSE DISPOSAL.

INTRODUCTORY.

By Hugh S. Watson, A. M. I. C. E., London, Eng.

THE importance of every town having a properly organized and well-conducted system of scavenging cannot be overestimated. In former years the substitutes for the modern science of cleansing were practically those which were provided by time and the elements, and it is therefore not surprising to find that epidemics of cholera and smallpox frequently occurred, carrying off many victims.

Nowadays every town of any pretentions has its scavenging department, the work of which is every whit as important to the general health of the population as that of the health department itself. There is no doubt that the cleanliness of our cities is as important to the public health as personal cleanliness is to the individual. Unfortunately, this fact does not yet appear to be realized by individuals themselves, and it would probably surprise the average citizen to know the amount of filth deposited on the streets of any large town by "the man in the street" in the course of a single day. A well-organized scavenging department can exercise a beneficial and far-reaching influence, for to it is intrusted, in a large measure, the comfort, convenience and health of the population, which is to say that it is made responsible for the general attractiveness and appearance of the town, considerations which will largely influence persons who may be considering the advisability of residing in the district, so that it may be said, also, to have an important influence on the general prosperity.

As some indication of the influence of efficient methods of scavenging upon the health of the community, it should be borne in mind that mud and dust are largely constituted of impurities from animals, many of which are diseased, and is also dangerously polluted with human saliva. Dr. Boobyer has described the composition of street refuse in the following terms:

"Street dust contains the following revolting constituents: The excreta of horses, dogs, cats, cattle, sheep and pigs, and, in poor neighborhoods, even of men. Then we have the sputa and nasal accumulations of poorer persons, suffering from catarrh and other diseases of the air passages (phthisis), the dropping of air-borne refuse from the scavengers' carts, and the sweeping from many houses, factories and workshops, notwithstanding any inhibitive by-laws in this regard.

"When we reflect upon this road dust of towns, the dust-raising nuisance of the motor car, so far as towns are concerned, assumes a specially serious aspect.

"There is little doubt that much of the excessive diarrhoea of towns is due to air-borne poison in the form of dust. From the bath bun in the pastry cook's window to the child's milk in the private larder, we know that exposed foodstuffs generally afford a nidus for the ubiquitous bacilli of the colon group and others.

"Finally, let it be our constant aim to minimize the generation of dust in all populous places, and where its production is inevitable, to secure the adoption of all reasonable means of keeping it out of the general atmosphere."

Again, Dr. W. Collingridge, medical officer of health to the city of London, in a paper read at the annual conference of the Institute of Cleansing Su-

perintendents in 1908, made some trenchant remarks on the subject of "Cleansing in Relation to Public Health." The following excerpts from a paper by such an eminent authority lend weight to the preceding paragraphs:

"The befoulment of our roadways is continuous, and varies with atmospheric conditions. In dry weather the dust nuisance is intolerable, unless the roads are sprinkled with water with more discretion than usually obtains.

"There is good ground for believing that much of the diarrhoea prevalent in the summer months is due to air-borne poison present in dust. Dust obtains access everywhere, and contaminates food both in the purveyor's shop and the private larder.

"It is disquieting to learn on the authority of Dr. Germans that he has proved the conveyance by dry dust of diseases, which he arranges in four groups:

"(a) Typhoid, plague, cholera, influenza.

"(b) Erysipelas, pneumonia, diphtheria.

"(c) Cerebro-spinal meningitis.

"(d) Anthrax.

"It will be seen therefore that those responsible for the cleansing of the thoroughfares are engaged in a constant crusade against disease, and the greater the density of the population in the area under their control, the greater are the difficulties and dangers they have to surmount."

Another aspect of the problem of scavenging is that of amenity, which has been so eloquently put in another paper presented at the annual conference of the same institute in 1902 by Mr. John Gibson, assistant inspector of lighting and cleansing at Edinburgh, that no apology is needed for quoting it here:

"It is inspiring to dwell in a town or city where neatness and cleanliness prevail, and see the brightness of such surroundings reflected in the spirit and deportment of the citizens. It may be well, in this connection, to remember that the outward is ever the expression of the inward; that the stranger within our gates, in looking at our thoroughfares, looks upon ourselves; that they are eloquent in witnessing for or against us, and that the silent verdict, favorable or otherwise, is final and conclusive."

THE ORGANIZATION OF A SCAVENGING DEPARTMENT.

No one system of scavenging can be said to be applicable to any class of town, as the requirements of each individual town will vary greatly according to the population, the nature of the businesses carried on, the configuration of the town, and the nature of the street surfaces. The organization of an efficient scavenging department is a matter requiring very intimate knowledge of local conditions, and, further, a practical experience of the difficulties to be overcome, and for this reason the author is of opinion that the best results will always be obtainable in those towns having their scavenging department placed under sepaarte control. In many cases where the control rests in the borough surveyor or the medical officer of health, considerable friction exists between the responsible chief and the official to whom the work of supervision is intrusted. The principal cause of this is that by reason of his many other duties the responsible chief has not the necessary time to devote to the requirements of the service, and consequently he cannot fully appreciate the difficulties of the official placed in charge. Another reason, which is an equally important one, is that the official in charge feels that any credit that may be due to him for the efficiency of his system will be entirely appropriated by his superior, while the responsibility for any breakdown will be directly visited on him. Where such a state of affairs exists it is obvious that the best results are not likely to be obtained, and it is therefore far preferable for each town to have its scavenging department placed under the supervision of one head, who shall be directly responsible to a scavenging or other committee.

The work of the department will fall under several heads, viz.:

Street Cleansing.
Day Service on Roads.
Street Watering.
Sanding of Roads.
Removal of Snow.
Control of Underground Lavatories, Urinals, etc.
Cleansing of Trough Closets.
Cleansing of Gulleys.
Emptying of Ashpits.
House Refuse Collection.
Refuse Disposal.
Clerical Department.

The street cleansing operations in most large towns are generally carried out by dividing the town into districts, the whole of the work being done under the direct supervision of an inspector, with the assistance of as many sub-inspectors as may be necessary. The work in each district is controlled

by a foreman, each of whom will be in charge of his own particular gang.

The strength of the gangs will vary according to the size and nature of the districts. The methods of street cleaning employed will also vary according to the nature of the surface coverings of the different roads.

The work is in some cases carried out at night time, and in others during the early hours of the morning, depending entirely upon the facilities, which will be governed by the extent of the traffic. In the author's opinion it is preferable to do as much of the work as possible during hours of daylight, not only because the work is more easily accomplished, but also because the men can be kept under better observation.

Considerable economy can also be effected, since under a properly organized system the district foremen can be made responsible for the whole of the scavenging service within their district, including the work of the orderlies, street watering and sanding, the emptying of gulleys, and cleansing of trough closets where such exist, as well as the collection of house refuse. If the street cleansing work is performed at night, special day inspectors will have to be employed to supervise these branches.

The keeping of proper records of the work done by the department is also a most important matter.

In some instances the cleansing superintendent prepares a weekly statement of the work to be performed in each district, and it is the duty of the district foreman to see that the work is done. The street sweepers, trough closet cleaners and the ashpit and gulley emptiers, hand in each night a list of the streets cleaned, etc., and these are entered on a sheet kept by the foreman, who hands it to the superintendent for entry in the books. Records of the amounts of the road sweepings, house refuse and gulley slops removed should also be kept, and the manner of disposal. It is only by the keeping of such records that the superintendent is enabled to compare the work done by the different gangs and to prepare his annual report.

THE LOS ANGELES AQUEDUCT.

Causes of Low Cost and Rapidity of Construction.

By Burt A. Heinly, Los Angeles, Cal.

THE building of the Los Angeles Aqueduct at the present time is calling the attention of municipal officials and engineers throughout the world to the rapidity with which it is being constructed and the low cost at which the work is being carried on. The reasons for this are as interesting to the municipal and hydraulic engineer as is the magnitude of the enterprise to the average layman.

The city of Los Angeles has voted $24,500,000 in bonds for the construction of an open and closed conduit to take the waters of the eastern slopes of the Sierra Nevada mountains as they flow into Owens river and carry the daily flood of 280,000,000 gallons southward across the Mojave desert, under the coast range and into the San Fernando valley, twenty miles from Los Angeles, where storage for irrigation and domestic use will be provided. The development of 48,000 electrical horse power with a peak load of 90,000 horse power, is one of the ultimate features of the enterprise.

The distance from the intake of the aqueduct to the place of outlet in the San Fernando valley is 230 miles, of which 217 miles is composed of tunnels. conduit, steel siphons and flumes, with the remainder of the distance composed of reservoir area. The size of the aqueduct varies with the grade, but a fair average is 10 ft. 6 inches by 11 ft. 6 inches. The length as divided into classes of construction as shown in the most recent report is as follows:

	Miles.
Unlined canal	21.08
Lined canal	152.25
Tunnels in rock	17.24
Tunnels in earth	11.08
Siphons crossing canyons	14.19
Flumes	1.72
Total	217.56

Since this report was published, the cheapness with which tunnel has been constructed has made it advisable to

increase the tunnel distance to approximately 33.5 miles, instead of 28.5 miles with a satisfactory reduction in expense and the total length of the aqueduct.

This, in a nut shell, is the Los Angeles aqueduct, the longest aqueduct in the world, and first undertaken in 1905 under some of the most adverse conditions that a hydraulic engineer has ever faced. Four more years remain for its completion.

The present rate of progress is five and one-half miles per month, or 66 miles per year. To obtain a better idea of the rapidity with which the work is going on, let us take the totals of the two last August ten-day reports, August 11 to August 21 and August 21 to August 31 inclusive. In the first ten-day period the tunnel excavation amounted to 5,224 feet, conduit 3,829 feet, canal 1,009 feet. In the second period the excavation was: tunnel, 5,038 feet, conduit 3,615 feet, and canal 561 feet. These are typical records of the last three months. During October, 1908, the United States 31-day 3-shift record for boring in hard rock was broken with a run of 466 feet. This was surpassed in March, 1909, with a run of 476 feet, and again in September with a run of 488 feet under adverse conditions. In April the 31-day, 2-shift record for tunnel boring in soft rock was broken by a run of 529 feet, and in August the 3-shift record of the world was eclipsed by a run of 1,061.6 feet. In the last instance the cost was $6.49 per lineal foot, a cost record almost as remarkable as the distance record. Since October, 1908, more than 20 miles of tunnels have been excavated.

With these instances let us turn to the conditions which have made them possible. These naturally divide themselves into five subjects: 1. Work of preparation. 2. Organization. 3 Politics. 4. Character of the men. 5. Housing, equipment and treatment of the men.

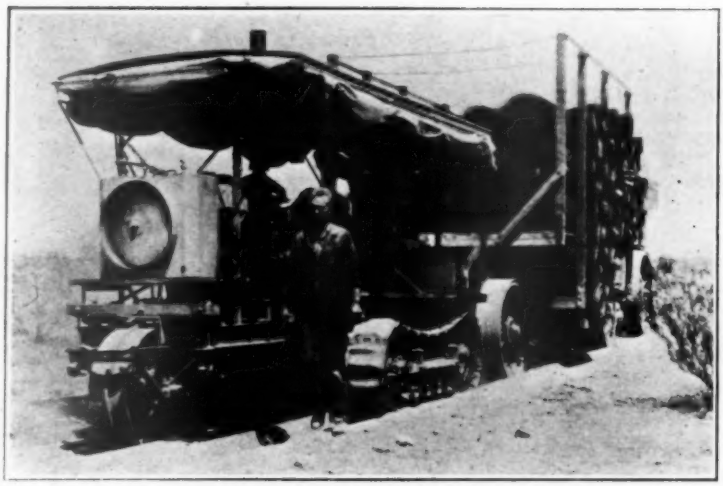
From the outset Wm. Mulholland, the chief engineer, was desirous that the work should be undertaken by "force" account under the direction of the city's engineers. This, with the exception of ten miles of tunnel and conduit in easy construction let to a contractor, is the policy that is being pursued by the Board of Public Works in aqueduct building. That it has been a wise move has been shown on the Jawbone division of 23 miles, where bids were called for. Here the aqueduct is being built at a cost which is 40 per cent. less than the lowest bid submitted.

The first issue of bonds for $1,500,000 was voted in 1907; the second issue of $23,000,000 was voted in June, 1907. Exclusive of the Elizabeth tunnel (26,860 feet) where, on account of the length, work was begun 60 days after voting the second bond issue, not a shovelfull of earth was thrown in aqueduct excavation until October, 1908. Fifteen months were devoted absolutely to getting ready. A barren inhospitable region, offering neither food nor sustenance and without means of transportation or communication had to be tamed. This work was almost Herculean in its magnitude. It included the building of a standard gauge railroad 120 miles long by the Southern Pacific, the construction by the city of 4 water systems with 148 miles of mains, 216 miles of wagon roads and trails, costing from $90 to $5,000 per mile, a telephone system comprising 377 miles of No. 10 single copper wire, three hydro-electric plants with a total capacity of 3,300 horse power, 218 miles of high voltage transmission lines, a cement plant with a capacity of 1,200 barrels per day, and more than 300 buildings, such as bunkhouses, mess-halls, warehouses, hospitals, offices, engineers' and clerks' residences, etc.

It is the history of public works that no sooner have funds been provided than the desire becomes apparent in the part of the people to have the work completed and "see something for their money." In this instance, whether through blind faith or understanding, Los Angeles citizens were content and no unfavorable comment was made when fifteen months after the bonds were voted a report was issued showing only 2,000 feet of aqueduct excavated and that on the Elizabeth tunnel. That the foundations were well laid has been demonstrated over and over again in the past twelve months.

The reports to September 10 showed excavation of tunnel 120,931 feet; conduit by steam shovels, 91,838 feet; canal by hydraulic dredgers, 18,129 feet; a total of 120,931 feet, or 43.8 miles. And the hardest part of the work is being undertaken first.

The organization consists of the central offices in Los Angeles, comprising the engineering, auditing, legal and purchasing departments. These in turn are directed by a committee comprising the three members of the Board of Public Works, one of whose



LOS ANGELES AQUEDUCT.

I. Caterpillar Traction Engine Hauling Materials.

LOS ANGELES AQUEDUCT.

II. Preliminary Road Construction and Power Line, Grey Ridge, Jawbone Section.

members, Lieut. Gen. Adna R. Chaffee (retired), is in charge of the aqueduct work and acts as chairman, the president of the Water Board and the heads of the legal, engineering and auditing departments with the city engineer. This committee meets in executive session. It has no legal or exly advisory, and yet it is the most powerful body of the aqueduct organization. It passes upon all questions of policy and upon all expenditures of any magnitude. It in turn reports by written recommendation to the Board of Public Works, which has in charge the bond moneys and the direction of construction on all public works,

The aqueduct is separated into eleven divisions, the length determined by the character of the construction and ranging from 6 miles, as in the case of the Elizabeth tunnel, to the Jawbone section, 23 miles long. Each of the divisions in which work is under way is managed by a division engineer. The engineering, purchasing and auditing departments work in conjunction, so that one keeps tab on the other. The total number of men in the field October 1 was approximately 4,000, and by means of the city's long distance telephone system, which reaches every one of the sixty camps, the forces are kept under the close personal supervision of Mr. Mulholland and Mr. J. B. Lippincott, his chief assistant. One or the other aims to be always in the field. It is just as impossible on a big job to have politics and at the same time to have celerity and cheapness of construction as it is to have your cake and eat it, too. Perhaps the whole secret of the success so far attained on the aqueduct is that politics has been ruled out with a strong hand. Gen. Chaffee makes short shift of any one seeking favor through other than actual efficiency. His appointment was forced by the public and he came into office with no political strings and no obligations. Mr. Mulholland, as superintendent of the city water works for more than twenty-five years, stands very firmly on the same basis, and this fact of itself gave a large amount of assurance to electors in the $23,000,000 bond election that politics would not be permitted to creep in to squander the money.

All clerical and all field positions above that of manual labor are filled through the City Civil Service Commission. This provides for a six months probationary period. To every man receiving employment above that of laborer it is explained that there is only one requirement, i. e., that the work set before him must be done in an efficient manner and to the best of his ability. This rule faithfully followed, he is told, he will be in line for better salary and position and that politics or favoritism will see no one advanced ahead of him. Failure to live up to the rule is equivalent to dismissal.

Preferment for excellence of work is being continually shown to the men now employed, as the work for the past twelve months has been broadening constantly. High reward is offered to practical experienced labor. The result of these requirements has been this: The Aqueduct Bureau in place of becoming a pension bureau for city hall hangers-on, or those who have outlived their usefulness and have received courtesy on the part of politicians, is filled with young and ambitious men, all Americans, who find it to their interests to make the best showing possible. A close tally system of costs, speed and thoroughness is kept in the general offices by a special department. These records are footed up every ten days and placed before the chief engineer and the advisory board, so that it it known by the "High Moguls" who are the men that are doing the work.

A construction superintendent who is ambitious knows that he is not lost in the shuffle. This system is carried to the length of publishing the quantity of powder used on each tunnel and the cost per ton-mile of hauling with each traction engine. When the chief engineer remarks to one of the 4,000 who is running a caterpillar engine: "Boyce, you made a good run this past ten days," or "Boyce, you're not holding up your end—something the matter with the machine?" Boyce knows that he is none too small to have his work pass unnoticed.

In hauling and in tunneling, the bonus system has been adopted. In other words, the city is willing to share with the men any advantage that the city gains in unusual progress. In the different tunnels the conditions are studied by the chief engineers and an estimate is made of the average distance that should be accomplished by one, two or three shifts as the case may be, in a 10-day period. A premium dependent upon the difficulties of excavation is then paid to each man for every foot that this distance is exceeded. Measurements are made every ten days. Now these conditions enumerated in the foregoing pay the city and pay well. The proof of this

LOS ANGELES AQUEDUCT.

III. Hydraulic Dredge Under-Cutting Face of Bank With Stream of Water Under High Pressure.

LOS ANGELES AQUEDUCT.

IV. Excavating Aqueduct Channel by Steam Shovel.

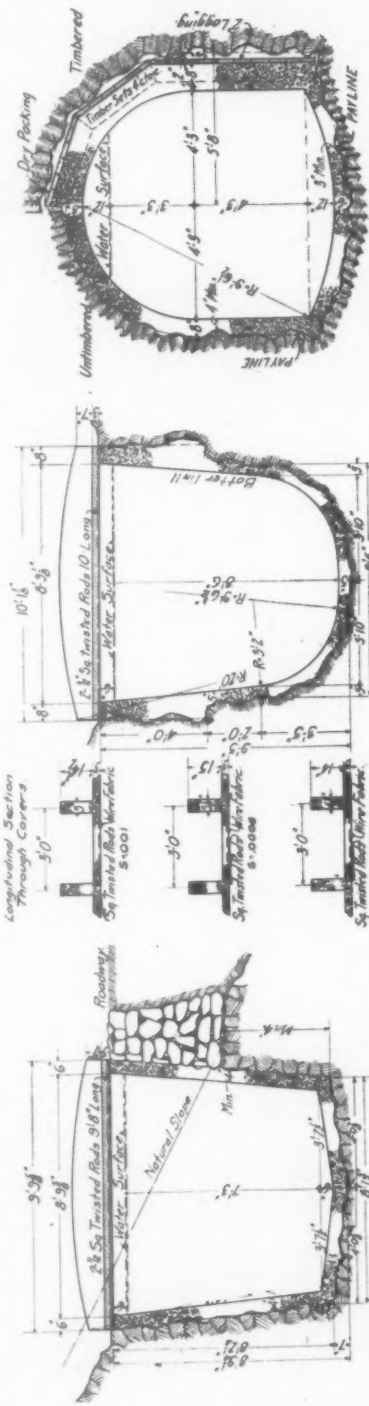
LOS ANGELES AQUEDUCT.

V. Putting Concrete Cover on Excavated Channel.

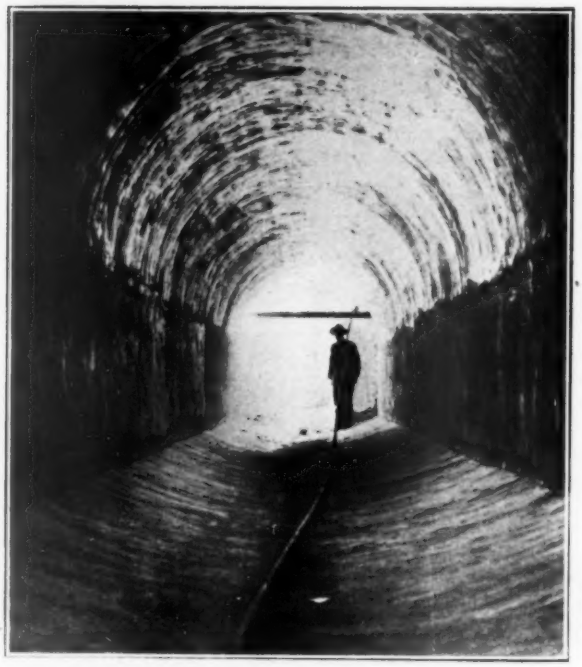
has been the results accomplished. And here is yet another feature that even the casual observer will not fail to notice. The system of no politics, advancement to the deserving and a reward for unusual work has resulted in bringing about an intense rivalry among the sixty different camps. The ten-day reports are blue printed and sent to each superintendent. From this he learns what all the other superintendents are doing on the job and neither he nor his men are desirous of seeing their camp at the foot of the column. If theirs is a crew or a camp working for a record, it is known along the entire 230 miles of line, and the details of progress go from camp to camp over the long distance aqueduct telephone line after it closes to official business at 9 o'clock p. m. The resulting esprit du corps makes every tunnel crew and every shovel gang jealous of its labor composition. From common laborer to the skilled workman there is a natural tendency to weed out the drones and the unfit. The obvious reason is that these classes will pull down the whole rate of progress. The good results of this to the city are just as obvious.

An eastern engineer in charge of one of the largest municipal engineerings undertakings in the country inspected the aqueduct last spring. The part of the work which called forth repeated comments of admiration from him was the quickness and business-like ability with which the men worked. The fact that superintendents, shift bosses and others who direct the movement of the forces were constantly in personal charge of their men surprised him. An indefatigable worker himself, he is coping with politics. The evil became the more apparent to him when he saw the advancement that is possible where it is a negligible factor.

The effort has been made to provide the men with the best accommodations possible. Day labor receives $2 per day and is furnished with lodging accommodations in bunk houses designed to best meet the climatic conditions, which range from as high as 116 degrees F. in summer to 10 and 20 degrees above zero in winter. The bunk houses are built to accommodate two men in a room which is well lighted and ventilated. It has cost the city on an average of $25 to each man housed. Engineers are provided with dwellings and charged a rental sufficient to pay for the cost of construction. All buildings are lighted with electricity.



VI. LOS ANGELES AQUEDUCT.



LOS ANGELES AQUEDUCT.
VII. Lined Tunnel, Jawbone Division.

The mess is under the charge of a contractor. At the opening of the work the city handled the commissary and served a high quality of food. As the work broadened and it was found that a large and separate organization would be necessary, it was decided that the city's ends would be best served by giving the department over to private parties.

The contract was let without gain to the city. It provides that the men shall receive the same quality and quantity of food which was furnished by the city; also, that the contract may be abrogated by the city at any time upon thirty day's notice. This last clause serves as a club over the head of the contractor to insure efficiency. City commissary inspectors make weekly reports as to cleanliness of kitchens, quality and quantity of food, and the way in which it is served.

During the past summer the commissary department was productive of much complaint on the part of the men in some of the camps. This was due in most instances to the severe climatic conditions making it difficult to procure perishable foods in any kind of condition, the embarassment of moving provisions considerable distances from the railroad, poor cooking or bad management on the part of commissary clerks. The conditions were promptly investigated by the Board of Public Works, the complaints in many instances were found to be entirely justified, and there was an immediate cleaning up. Cool weather has also cleared the situation.

All unmarried men are required to board at the city mess at the rate of twenty-five cents per meal. The same rations are served to all classes employed, from the assistant engineer in charge of the division and his superintendents down to the day laborer.

The health of the men is maintained by a medical organization, with hospitals, doctors and nurses in each division. Major operations are performed in Los Angeles at the California Hospital, one of the finest institutions of its kind in the city. One dollar per month is deducted from each man's salary for hospital dues.

The liquor problem is believed to have been almost entirely solved. Before the work was well under way the aqueduct's legal department procured the passage of a law by the state legislature which prohibits the location of

a saloon or grog shop within four miles of any aqueduct camp of more than twenty-five men. This act also provides for the closing of any saloon coming within the above provisions of the law and which had not been in existence for at least two years. The passage of the bill was secured by the city only after a very hard fight against the allied liquor interests of the state, but the effort brings large reward. Desert heat and rot-gut whisky do not mix at all, and the effect of intoxicants on the human working machine becomes quickly apparent in this climate. Mr. Mulholland, at the time the city was working for the passage of the act, estimated that if the gin shops already going up along the line like mushrooms over night could be put out of the way, the city could save from $3,000,000 to $4,000,000 in the greater working capacity of its employes and the organization by which they are held together and directed.

In addition there is a rule rigidly enforced which provides for the immediate dismissal of any employe bringing intoxicants into an aqueduct camp. A man who reaches his limit of resistance is given his time check and told to go. If he is a good laborer or miner he is told when he returns thoroughly sober and fully recovered from his debauch he will be taken back, but not otherwise.

The Los Angeles Y. M. C. A., with an aqueduct secretary in the field backed by private subscriptions, seeks to provide reading matter, writing materials, clean entertainment and recreation for the men. This organization has a very active campaign mapped out, as soon as an appropriation is made by the city for the purpose.

In summation, the organization, the high character of the labor employed, the entire absence of politics, the esprit du corps of the men, the willingness of the city to recognize their efforts and the desire of the city to give them the best possible conditions under which to work, it is believed, have brought the development of a human working machine, without equal, so far as is known, on any public work of this magnitude.

LOS ANGELES AQUEDUCT.

VIII. Tom Flanigan, Whose Crew Broke the World's Record for Tunnel Boring.

TAR IN THE SURFACE TREATMENT OF ROADS.*

By Harvey J. Skinner, Engineering Chemist, with Arthur D. Little, Inc., Boston, Mass.

THE problem of preserving the surface of roads and highways and the prevention of dust has been given attention by highway engineers for many years, but not until the year 1905 was the question seriously considered was the question seriously considered in the United States. The increasing use of automobiles and motor vehicles about this time introduced a new condition to be considered in the building and preservation of roads. Reports from various parts of the United States, England, France and wherever the use of motor vehicles had become common, showed that the automobike was exerting an extremely destructive effect upon road surfaces.

The macadam road has especially been subjected to this destructive action, since it is the form of construction most commonly adopted for modern thoroughfares. The binder or fine material upon the surface of the road is removed by the constant passage of automobiles, thus exposing the larger stones, which become loose and which are either left on the surface or in windrows along the sides of the road. The roughened surface presents greater resistance to traction and allows water to percolate to the foundation of the road, thereby seriously injuring the whole structure.

Up to this time the macadam form of construction had been very satisfactory for the character of traffic for which it was designed, namely, that of iron-tired horse vehicles. In a perfectly constructed macadam road the rock used is so adapted to the kind and amount of traffic that the fine material worn off from the rock replaces that which is removed by atmospheric agencies. Under ordinary conditions, it has been possible to maintain a hard and smooth surface at a moderate expense.

The advent of the automobile has changed very materially the character of the traffic. The action of the rubber tires is very different from that of iron tires, and practically no dust is worn off to replace that removed by ordinary wear. The great tractive force or shear exerted by the driving wheels of motor vehicles is the main cause of this injurious effect. It has been demonstrated by a series of experiments in which separate speedometers were connected to the front and rear wheels of automobiles that there is a very appreciable amount of slipping of the driving wheels on the surface of the road. This slipping effect throws into the air large quantities of the fine surface material, which is caught by the air currents generated by the car body and subsequently removed from the road by the wind.

Aside from the disintegrating action on the road, the dust raised by automobiles is a menace to health and a source of great discomfort to those living near much traveled highways, especially in residential sections. Another consideration of importance is the damage to property, and instances are recorded where country estates have been disposed of far below their value, and farms and orchards abandoned, owing to the dust nuisance.

The increasing number of automobiles each year emphasizes their importance as a factor to be taken into consideration, and consequently highway engineers have given careful study to the necessity of making a change in the present practice of road construction, as well as evolving some method of preserving the surface of the enormous mileage of roads already built.

The increased cost of maintenance resulting from these changed conditions has resulted in a search for some method of surfacing other than that commonly used on macadam roads. Various materials have been proposed and used, some of which are temporary in their nature and are simply intended as dust preventives. Others are more permanent in character and are advantageous in actually binding the surface of the road together, thus becoming an integral part of the structure. Of this latter class, crude oil and tar are the most important, and numerous preparations of these materials have been used with varying degrees of success.

Coal tar has been employed in road building for many years. Tar macadam roadways were constructed in Not-

*A paper before the American Gas Institute.

tingham, England, as early as the year 1840, although under rather crude conditions. Coal tar pavements have been tried in various parts of the United States, but as a rule the results have not been satisfactory, asphalt being found superior as a paving material. In more recent years, tar macadam roads have been quite successful, and this form of construction is now used to a considerable extent.

The application of tar to the surface of a completed macadam road, while comparatively new in this country, was tried in France about forty years ago. The results were rather unsatisfactory, but the practice has been carried on to some extent at intervals since that time, especially in Italy and France.

In the United States, the first experiment which attracted the attention of road engineers was in the summer of 1905, when a series of careful experiments were made at Jackson, Tennessee, by the United States Officer of Public Roads, in cooperation with the city engineer of Jackson, to determine the value of coal tar in the treatment of broken-stone roads. The widespread interest created by these experiments led to similar ones in various parts of the country, particularly in Massachusetts, Rhode Island, New York, New Jersey and Pennsylvania.

The variation in the methods of application and the lack of attention to the quality of the tar and the condition of the road have led to a difference of opinion as to the real value of coal tar in surface treatment.

The methods of applying the tar have varied considerably, but perhaps the one more generally used, especially in the earlier experiments, is to remove the dust and all loose particles by thoroughly sweeping the surface of the road and then applying the tar from an open kettle mounted on wheels and fitted with a portable firebox. The tar is brushed over and into the surface with stiff brooms such as are ordinarily used for street work. The kettle is kept in advance of the workmen and by using two kettles and heating one while the other is in use, the process is made continuous. After allowing the tar to soak into the surface for at least ten hours, it is covered with a layer of sand or fine stone screenings. When several hours have elapsed the road is completed by rolling with an ordinary steam road-roller.

In some places, and particularly in Europe, mechanical means have been employed for applying tar. Some years ago the Road Improvement Association held in England a competitive trial in which many of the machines were fitted with ingenious devices. Nearly all of them provided for heating the tar and applying it under pressure by means of compressed air. Some of them were designed for carrying on the whole operation with one passage of the vehicle. The dust and loose particles were first removed by suction and drawn up into a receiver. The tar was then applied by compressed air and spread over the surface of the road by means of automatic brushes. The fine material previously removed was again distributed over the surface and rolled by the steam-heated wheels of the machine. Some of these machines were drawn by horses and others, the larger ones especially, were self-propelled.

The method most commonly used at the present time is a compromise between strictly surface application and tar-macadam construction, and is known as the penetration method. In this method the surface of the road is broken up by means of a scarifier, new material added to fill ruts or other depressions, and the road reshaped. After a slight rolling without the addition of water, the tar is applied and allowed to stand as in the previous method. A dressing of fine material is then spread over the surface and the road well rolled, with the result that a surface is formed in which all of the spaces between the hard stone are filled with a minimum amount of tar. A road treated in this manner is similar to one built by the tar-macadam process, in which the stone and tar are mixed before being laid.

Many of the trials which have been made with tar as a surfacing material have failed because of a lack of appreciation of a number of important details. The structure of the road, its condition at the time of treatment, the traffic to which it is subjected, the character and amount of tar used, are all important factors which are necessary for successful results.

The structure of macadam roads varies according as each engineer has deviated from the original method of macadam construction to meet his own ideas. As a rule, however, the formation of the road is much the same, and is of minor importance in comparison with the actual condition of the surface at the time the tar is applied. The road should be dry and as free from moisture as possible, since water and tar are not miscible in any sense, and if the tar is applied to a wet road, the latter is, so to speak, tar proof, and

penetration is impossible. In such a case, peeling of the surface is very liable to result, owing to the tendency of the tar to remain on the surface as a crust. It is equally important that the road surface should contain as little dust or loose material as possible, as the latter will absorb the tar instead of allowing the tar to be absorbed by the road. This again results in the formation of a crust, which under certain conditions will peel off, leaving the exposed surface of the road comparatively free from tar.

The kind and amount of traffic to which different roads are subjected is very variable, and in cases where the traffic is particularly heavy or excessive, ruts and hollows are sure to exist. These irregularities in the surface make even rolling impossible and unless repaired previous to tarring, water will collect in them and soon exert a detrimental effect upon the tarred surface. In many instances traffic has been allowed on the road too soon after treatment, and this alone has been the cause of a number of failures.

The character of the tar is of equal importance to the condition of the road. Tars vary widely in composition even when produced by the same process. The character of the coal used, the method of carbonization and the temperature of distillation all have a decided influence on the composition of the tar. The value of coal tar in the surface treatment of roads depends almost entirely upon the binding power of its heavy bitumens. Besides these bitumens, there are present other substances, such as water, ammoniacal liquor, oily constituents including the light oils and the creosote or "dead" oil, naphthalene, anthracene and similar compounds, and free carbon, the proportion of which varies according to the manner in which the distillation process has been carried out.

The presence of water in coal tar has a similar effect to moisture in the road. If a tar containing water is applied to a dry road, the latter absorbs the water more readily than the tar, producing the tar-proof effect to which reference has already been made. Difficulty is also experienced in handling tar containing an appreciable amount of water, since the water causes foaming, and if the vessel is heated by direct fire the danger of the tar going over the side of the vessel and taking fire is great.

Ammonia is another undesirable constituent, it being alkaline in nature and having a tendency to form with the oil constituents soluble compounds which are easily washed out by the action of the rain.

Naphthalene and anthracene, while they exert no particularly harmful effect as in the cases of water and ammonia, have no binding power and their presence simply reduces the amount of bitumens which may be present.

Free carbon, like naphthalene, has no detrimental effect, but, on the other hand, it is a useless constituent so far as road treatment is concerned, and its presence reduces the binding power and waterproofing effect, since it possesses none of these qualities itself.

The oily constituents of the tar are valuable to some extent, since they act as diluents. The oils are more or less volatile and are probably evaporated soon after the tar is applied to the road, but their presence makes the tar thinner and consequently renders the application easier. The creosote oils are also of some advantage, as it is claimed they add life to the tar and prevent it becoming too brittle.

The amount of tar is another important detail, and if more is applied than the road can properly absorb, it will remain on the surface and be taken up by the top dressing with the resulting formation of a crust. Another objection to an excessive amount of tar is that it has a tendency to become sticky in warm weather and slimy in wet weather.

Sand or fine stone screenings have been used as a top dressing in the majority of the trials with coal tar, although occasionally the fine material removed from the road previous to tarring has been used. Stone screenings are probably the best material to use on a macadam road, since they furnish a dressing of the same material as the road itself.

A comparison of coal tar with other road binders and dust preventives is somewhat difficult in the absence of really comparative experiments. Some few trials have been made in which different materials were used on the same stretch of road, but in most cases those experiments using such materials have been on different sections of roadways and consequently the results are not truly comparable.

Another cause for lack of comparative data lies in the great diversity of materials which have been used. As we have seen, the efficiency of a dust preventive is in proportion to its binding power and, therefore, a comparison of only those materials of ap-

proximately the same binding power is justifiable. The various dust preventives really form a series from water, which has no binding power, up to coal tar and the heavy asphaltic oils, which have the maximum binding power of any of the materials yet proposed.

Water, salt solutions and light oil emulsions are of the nature of temporary binders and are not to be compared with the more permanent ones, such as coal tar and oils having an asphalt base.

The use of oil has been confined largely to the United States, and by far the greater portion of the work has been done in the West, owing to the proximity of the oil fields, which supply oils with an asphalt base. In the eastern portion of the United States the cost of transportation has been so great that comparatively little experimenting has been done with oil. Tar has been used quite extensively abroad, especially in England and France. In the United States its use has been confined very largely to the Eastern and Northern States, although the park authorities of the larger cities have used tar to quite an extent.

Experiments have pretty clearly demonstrated that tar is not adapted for the treatment of gravel or soft earth roads, owing to the fact that it does not amalgamate sufficiently well with these materials to bind them together. For roads of this class, therefore, oil has been more successful than tar. The use of tar has been and must be confined almost entirely to macadam or broken-stone roads, and for roads of this nature it is probably more suitable than oil.

Oil, as a rule, has greater power of penetration than tar, but its value is dependent in a large measure on its asphalt base, and before its maximum binding power is reached the more volatile constituents of the oil must be allowed to evaporate. This evaporation is a slow process, and until it is complete the disagreeable odor of the crude oil will be apparent and more or less objectionable. The use of oil has also received considerable criticism owing to the damaging effect which it has upon clothes and the paint and varnish of vehicles, especially in damp weather, when a greasy, disagreeable mud is formed.

Tar, on the other hand, solidifies quite completely as soon as it its cold and does not depend except to a small degree on the gradual evaporation of its volatile constituents for its hardening. It is comparatively free from the objection of being picked up and thrown by the wheels of vehicles, and although it has a decided odor which lasts for a short time after application, this is not particularly objectionable and to most people is much less offensive than that of crude oil. An objection is sometimes raised to the use of tar on account of a fine black dust which wears off of the tarred surface. It is true that such a dust is formed, but the amount is insignificant in comparison with the dust which would have formed if the road had been untreated.

It is claimed that coal tar has a decided antiseptic value, but how much importance can be attached to this feature is questionable. It is reported that an investigation was carried on in France to determine the number of germs present in the atmosphere over a tarred and an untarred road in the same neighborhood, and the number over the latter was found to be considerably in excess of those over the tar-treated section. Crude oil also possesses a similar antiseptic property, but to a very much less degree.

A properly tarred road is similar to an asphalt pavement, although of a more resilient character. The stone is all bonded together by the tar into a smooth, firm surface which can be swept and washed in much the same manner as an asphalt pavement.

The principal agencies which cause deterioration of tarred or oiled surfaces are heavy rain, frost and the decaying organic matter which accumulates on the surface of the road. So far as can be determined, one kind of road withstands the action of these agencies as well as the other.

Water gas tar is used in connection with coal tar, but not to any great extent by itself. It has a greater power of penetration and less of it is required, but it is not so lasting in character. It is really in a class by itself and occupies an intermediate position between the temporary and the permanent binders. In some cases, where a limited amount of money is available, or where for climatic reasons it is advisable to treat the road with the idea of its lasting only through one season, water gas tar should prove a valuable dust layer, and any extension of its use will undoubtedly be in this direction.

The value of coal tar in the preservation of macadam roads and as a dust preventive, is still unsettled. It is certain, however, that in the majority of cases the life of a treated road has been materially lengthened, and by ap-

plying tar the complete rebuilding of many roads at an enormous expense has been avoided.

One great drawback in the standardization of tar treatment is the impossibility of securing a uniform supply of coal tar. Coal tar is purely a by-product, and the processes by which it is derived are never run with reference to the quality of tar produced, but solely to obtain maximum yields of gas or coke, as the case may be.

The impossibility, therefore, of manufacturing tar to meet definite requirements makes it necessary to utilize the supply available, but in so doing a certain amount of selection can be exercised and changes made whereby some degree of uniformity is obtained.

Strictly surface treatment of an already existing road, even under the best conditions, can only be regarded as a temporary expedient, and its use will probably extend only in cases where for financial or other reasons the rebuilding of the road is not justified.

Partial reconstruction of the road, whereby the surface is loosened, reshaped and the tar applied before the rolling is done, is undoubtedly a method of considerable value, and one which will find more general application in the future. Many highway enginers have predicted an entire change in the methods of road construction, but it is difficult to believe that the macadam method, which has been so universally and so successfully used for a long time, can be eliminated. It is more probable that some modification of the macadam form of construction will be adopted, in which event the tar-macadam method is sure to be one of the first to receive serious consideration.

CONTROL OF WORKMANSHIP ON ASPHALT PAVEMENTS.*

By L. Kirschbraun, Municipal Asphalt Laboratory, Chicago, Ill.

UNDOUBTEDLY there have been more failures on account of improper mixing and handliing of good materials than in the use of inferior ones. To secure good results depends not only on laboratory inspection, but also upon trained inspectors at the asphalt plant when the mixtures are prepared and at the street where the materials are being laid.

Upon the establishment of an asphalt plant inspection bureau for the city of Chicago by the late Andrew Rosewater. M. Am. Soc. C. E., general instructions were issued to plant inspectors which read as follows:

Inspectors at asphalt plants are hereby instructed to take note daily of the materials used in the proportioning of paving mixtures, both as to their physical nature and the quantities, by measurements and weight.

It is desirable for the preparation and maintenance of proper records in connection with work, under contract with the city, to note the name and brand of each kind of material used, and in compounding mixtures to see them measured and weighed and observe, whatever proportions are used in the various mixtures, whether a uniformity is maintained, and if no uniformity or system is observed, to embrace such facts in the reports.

Contractors are expected to afford all necessary conveniences for such inspections. If obstacles are placed in the way of securing desired information, or facilities are denied by any contractor, the inspector must note same in his daily report, with the alleged reasons.

Samples of asphaltic cement used shall be sent daily to the laboratory for testing purposes, also the street surface mixtures. Separate samples of other materials called for by the chemist shall be taken for examination and test to the laboratory. Anything relating to materials received at the plant, or to operations in their mixture and handling, shall be noted on the daily reports sent to the laboratory.

In addition to these general instructions the points to be watched in preparing the mixtures may be set forth briefly as follows:

In the preparation of the asphaltic cement it is essential that the refined asphalt and flux be weighed into the kettles in such proportion as to produce the desired consistency. The temperature of the kettles must be regulated by the inspector within the limits

*From a paper in *The Michigan Technic.*

which the asphalt cement in question can properly sustain. In combining, the flux and asphalt should be sufficiently agitated to produce thorough solution, and with asphalts containing much mineral matter, to avoid settling out of such, with consequent lack of homogeneity in the cement and resulting mixtures.

The consistency of the asphalt cement is varied to produce a hard or soft pavement, or to meet the requirements of a fine or coarse mineral aggregate. It is desirable, other conditions being the same, that for any piece of work the consistency be uniform to a standard which experience with each asphalt has demonstrated to be satisfactory. Consistency is determined by the penetration machine, which operates by measuring in tenths of a millimeter the depth of penetration into a sample of the cement at 77 degrees F. of a No. 2 needle under a weight of 100 grams for 5 seconds. Where there are facilities for testing at the plants it is the duty of the inspector to test each kettle before use. When there are no such facilities an experienced inspector can determine an approximate consistency by chewing a sample of the cement. In any case, samples of each kettle are sent in daily to the laboratory for checking, and close control and record are kept of them.

Two kinds of binder are in use at present in the paving industry, an open and a closed binder, or asphaltic concrete. The open binder is made of well graded stone 1½ inch to ¼ inch limiting sizes, coated with asphalt cement. Asphaltic concrete, as the term implies, differs from the open binder in having the voids of the stone filled with an asphaltic mortar of sand and fine screenings, making a dense and compact medium. This is much superior to the open binder in its ability to support the surface rigidly and to prevent crushing of the top into the interstices of the binder under heavy traffic.

The main cause of trouble with open binder is overheating—not necessarily on account of injury to the cement, but because of the fact that the coating of cement will run off of hot stone to such an extent that at the end of a long haul the top three-quarters of a load will be so devoid of cement as to be insufficiently bonded when laid, while the material in the bottom of the wagon contains an excess of "juice," making it difficult to rake, and forming, when rolled, "a grease spot." This in the course of years is absorbed into the top, softening it and resulting in displacement or grinding out. The only test of a good open binder is that it should appear, on close inspection with the eye, to be uniformly and well coated, and when rolled and cold, should sustain the traffic incidental to laying the top without breaking up. With closed binder, there is not so much danger of separation of the cement, but the point most generally overlooked is in getting a uniform amount of fine material mixed with the stone, and this can be accomplished only by receiving the stone and sand in separate bins and mixing them in uniform proportions. This material, when laid and compacted, should, on breaking, appear solid and well filled, but not over-filled.

The proper proportioning of the materials entering into the wearing surface presents the most difficulty, for the reason that the amounts of asphalt cement, filler and sand vary and are interdependent upon each other, according to the characteristics of each material. Failure to recognize this fact, and work by rule of thumb, has produced many unnecessary failures. Density, toughness and elasticity are the characteristics to be sought for in preparing a durable mixture, and wide latitude is usually allowed the contractor in producing this result. Unfortunately, such latitude often leads the contractor to economizing on such materials as increase the cost, so that it is much more satisfactory to specify, within reasonable limits, certain requirements of bitumen and aggregate as have been shown by actual practice to produce successful results. These requirements, as provided in the new specifications prepared for the city of Chicago, are as follows:

	PER CENT.
Bitumen soluble in cold carbon bisulphide	10.5—13
Portland cement and mineral dust passing a 200 mesh sieve	12.0—18
Sand passing an 80 inch sieve	18.0—18
Sand passing a 40 mesh sieve	30.0—50
Sand passing a 10 mesh sieve	8.0—20

The sieves being used in the order named.

A mixture prepared without discretion, to come within these limits, might still be unsatisfactory. For example, should the mineral aggregate grade according to the maximum coarseness allowable, a bitumen content of 13 per cent. would be entirely too much, likewise an extremely fine aggregate would have more than the

minimum percentage of bitumen to produce a satisfactory mixture. Given a sand of a definite grading and a specified amount of filler to be incorporated, the amount of asphalt cement to be used can be regulated by the appearance of a stain produced by compressing a portion of the hot mixture between a sheet of light manila paper. If the mixture is rich, the excessive amount of asphalt cement will stain the paper heavily; if dry, the stain will be light. In making this test, it is necessary to consider the temperature of the mixture tested and the manner in which the pressure is applied. A very hot sample and excessive pressure will indicate a degree of saturation not at all true, so that it is necessary to apply such test with discretion.

It is the duty of the inspectors at the plant to watch the surface mixture as produced, very carefully, and to make such rough tests as described above to ascertain its correct proportioning. When a mixture has once been established as satisfactory, it is their duty to see that the established proportions are uniformly mixed. The carelessness of the men employed in the actual mixing of the material is sometimes remarkable. The great desire at many plants is to turn the mixture out fast. The greater output means economy in cost of production, and in the attempt to hurry the mix the proportions are often inaccurately gauged and the material is imperfectly mixed. The measuring and weighing devices are liable to get out of order and register inaccurately, and many a street, the mixture of which has been planned with the best of intention, has been faulty for reasons of this nature. The inspector must see that nothing of this sort occurs, that the mixture is actually being produced according to approved proportions. While any error would eventually be checked up by the laboratory, in a large city it might be days before this were accomplished.

The temperature at which the mixture is produced is of great importance, and there is a tendency among most plant men to neglect this altogether, or to heat the mixture unnecessarily in order that it may work easier on the street. The minimum heat compatible with proper workmanship is desirable. There is no occasion for heating above such a temperature. A mixture may not be actually burned by an elevated temperature, for there is every stage of injury between being first-class and the final stage of being burned, and while a mixture may show very little evidence of heat injury, its ultimate life may nevertheless be seriously shortened. Inspectors are required to hold their mixtures at low workable temperatures, keeping the sand passing out of the drums at such heat as to insure the desired temperature in the final mixture. Plant inspectors report daily on the following form:

REPORT OF ASPHALT PLANT.

Plant No. 8. October 14, 1908.

ASPHALT CEMENT.

KETTLE NO.	LBS. FLUX TO 100 R. A.	KIND OF ASPHALT
1	22	Top, Trinidad
2	22	.....
3	22½	Binder, Trinidad

Kind of Flux, Texas .....

BINDER	LBS.	TOP	LBS.
A. C.	65	A. C.	165
Sand	105	Dust	110
Stone	815	Cement	.....
.....	.....	Sand	740
Total per box..	985		1015

No. boxes binder, 42
Sent to Lake Ave., 37th St. to Oakwood Blvd.

No. boxes top, 300
Sent to Lake Ave., 37th St. to Oakwood Blvd.

New materials received this day:
1 Car Trinidad Asphalt
3 Loads Stone Dust

Remarks .....

A. SMITH, Inspector.

Samples of the mixture are sent in daily to the laboratory from the street in a special envelope giving necessary data as shown in the following form:

CITY OF CHICAGO—BOARD OF LOCAL IMPROVEMENTS

Lab. No. .... *Oct. 14, 1908.*

Sample of Asphalt Top from *Lake Ave.*
Between *37th* and *Oakwood Blvd.*, Opposite House
No. *3902* on *West* Side of Street ....
Here is inserted a plat of the square on which a star locates the place from which the sample was taken.

Load No. *18*
Time *11:15 A. M.*
Plant *8*

Remarks .....
.....

O. H. NOYES,
Sub-Paving Inspector.

The street inspection in the city of Chicago is under separate head.

These samples are analyzed and filed.

From the descriptions given it is possible to locate defective mixtures, and, further, at the end of the season, it is possible to make up plats of each street showing where various mixtures and various materials have been laid. To assist in this the plant inspectors are directed to locate in the street points where new materials or changes of mixture have been made, so that in after years it would be possible to judge of the causes of failure or success of any street with accurate knowledge of materials and conditions under which it was laid. A final record is made up and filed, giving complete data regarding the street, including plats, nature and analysis of all materials used in its production, with daily record of the composition of the mixture and any physical condition of base, sub-grade and traffic affecting the life of the pavement.

In conclusion may be emphasized the absolute necessity of keeping accurate records as described above. For scientific progress in this industry it is essential that the actual results obtained be closely observed, so that with known conditions it is possible to benefit by good results, to be able to reproduce them and to avoid such influences as are demonstrated to involve error and failure. An asphalt laboratory is valuable only for the practical results attained, and not for new theories evolved each year, unless such theories are sufficiently demonstrated by actual results obtained, under known conditions.

LITTLE ROCK, THE CITY OF ROSES.

By E. A. Kingsley, City Engineer.

LITTLE ROCK, Ark., is a beautiful city, a city of beautiful homes, beautiful churches and beautiful club buildings. But, above all things, it is a city noted for the beauty and loveliness of her women and brightness of her flowers. Little Rock has won a title fanciful and poetical, but merited and deserving, "The City of Roses." Usually until the frosts of November and oftentimes as late as December, the fragrant roses and beautiful autumn flowers bloom freely. At the time of this writing, late in October, the yards are full of beautiful and fragrant flowering plants.

The city proper is situated upon the south side of the Arkansas River, almost midway between the Oklahoma line on the west and the Mississippi River, or the Tennessee line, on the east. It is situated on the rolling land just where the Arkansas River leaves the Ozark Mountains to stretch its winding course through the valley and plains between the Mississippi River and the mountains.

In the years gone by, when the country was inhabited by Indians, there was a landing place at a small rock ledge on the south bank of the river. This ledge was afterward one corner

of the Quapaw Indian Reservation, and in later years became the east landing of the first bridge across the river, ascending after leaving the Mississippi.

About a mile above this little rocky point, but on the opposite side of the river, was an immense trap-rock bluff rising abruptly from the river bank several hundred feet. The Indians designated these two points as the "Little Rock" and the "Big Rock," they being the first rocks encountered in a trip up the river from the south.

Upon the flat plain on top of the "Big Rock" prominence the U. S. Government has now located a magnificent government fort (Fort Logan H. Roots), it being one of the most beautiful locations in the country and a sight well worth seeing.

Around the "Little Rock," on the south bank of the river, about one hundred years ago, was formed a little trading post and taking the name so common and well known to the Indians, "Little Rock Landing," gradually came to be "Little Rock Post Office," and afterward just plain old Little Rock.

In 1821 Little Rock became the capital of the Territory and in a few years one of the most important points in the Territory. The Territory at one time was covered with vast and heavy growths of pine and hardwood timber, but for miles around now almost all of this is gone and in their stead the forests have given way to fertile fields of cotton, corn and rice.

In 1909 Little Rock has become a city of probably 70,000 people, with a sister, Argenta, on the north side of the river, containing probably 15,000 more people.

For many years Arkansas has become neglected in the mad rush across the State to Texas and the Far West, and the railroads have not done the building that has been done in other States. And real Arkansas has been unknown to the outside world. It was not until about 1900 that Little Rock, then a city of 40,000 souls began to realize that there was a future ahead. At that time our city had 2.85 miles of streets paved with brick and granite blocks, none with asphalt, and a total of 17.25 miles of sanitary sewers. At the present time there are ten miles of brick and granite-block streets, 5.6 miles of asphalt and more than 15 miles of macadam. Next year there will be built probably 6 or 7 more miles of brick and asphalt pavements.

In the period since 1900 the sanitary sewer system has grown from 17¼ miles to more than 60 miles.

The Arkansas State Schools for the Blind and for the Deaf and Mute are both located in Little Rock. The State Insane Hospital, the State Penitentiary and the State Reform School for Boys are located here, and the new State Capitol building is under construction.

The main engine and car shops of the Iron Mountain Railway System are located here; the Ayer & Lord Tie Company have a large creosoting plant here, and there are several big cotton compresses and cotton oil mills in the city. The Iron Mountain Railway Company has just opened its new quarter-million-dollar passenger station in the western portion of the city, and the Rock Island road has a splendid little depot in the east portion of the city.

Two years ago the new Marion Hotel was opened, and this year the remodeled Capitol was opened to the public. Not a hotel anywhere in the country is superior to either house.

The Newmans, of New Orleans, own the Little Rock street car system, and the service is far superior to the average street car service in cities twice the size of Little Rock.

On the north side of the river, just at the foot of Big Rock, there is an immense crushing plant, which furnishes thousands of tons of trap rock annually. On the south side and west of the town is the immense brick plant of the Arkansas Brick & Manufacturing Company, where has been installed recently a new paving brick plant.

Among the better buildings of the city are the First M. E. Church, South; the new Second Baptist Church, the Roman Catholic Cathedral, and the Jewish Synagogue. The Scottish Rite Cathedral is a gem, and the Concordia (Jewish) Club and the Quapaw Club are three splendid social club buildings. Recently a Carnegie Library building has been erected at a cost of $80,000, and the Majestic vaudeville theater building at a cost of $50,000. A new steel building 11 stories in height is being erected, and the Marion Hotel is building an eight-story addition. And the U. S. Government is just completing a $100,000 addition to the beautiful Post Office building. Several fireproof buildings are planned for next year.

Little Rock is really an example of the spirit in vogue in connection with the New South. To those who have not visited the city it will be a surprise and an education.

AN ARTISTIC BASCULE BRIDGE AT COPENHAGEN, DENMARK.

By C. Van Langendonck, Brussels, Belgium.

SINCE December 30 last the city of Copenhagen has possessed a handsome new bridge of the double-leaf bascule type, which provides improved facilities for communication between the city, properly so called, and the suburb of Christianshavn, on the Island of Amager. The bridge has a length of 258 feet between land abutments and spans the harbor channel, which has a depth of 25 feet 6 inches. The movable part of the bridge spans a part of this channel having 92 feet 6 inches clear width. The new bridge is constructed upon ornamental lines and in harmony with the picturesque character of the neighboring buildings.

The bridge is thrown across the waterway at a point directly north of the structure it superseded and the banks of the channel had to be regulated and the bridge set at the correct angle to the current, so as to insure navigation on the river being completely satisfactory.

Owing to the heavy traffic on the waterway, it was quite impossible to build the piers on the spot, and they were constructed at a convenient point in the harbor, and then towed into position and set upon the foundations. The piers, which have an over-all length of 78 feet 8 inches, for a width of 26 feet 6 inches, are provided with chambers, into which descend the tail ends of the leaves, with their counterweights, when the bascules are raised, and they also contain a large portion of the hydraulic machinery.

They were constructed on slips and were provided with strong water-tight bottoms, built up of ring-shaped iron girder and transverse members, to the under side of which the bottom plates were riveted. To the outside of the ring-shaped iron girder was attached the vertical sheet-iron plating forming the wall of the caisson. For purposes of launching this was only carried up to a height of a few feet. Launching was carried out in the usual manner. Concrete was then laid on the bottom to form a foundation for the masonry, which was so built as to form a surrounding wall with transverse walls serving as buttresses and with locks between. This work was carried out while the pier was floating, and as the mass gradually sank under the superimposed weight of the masonry, the sheet iron lining was continued upward, a height of about 3 feet thereof always being maintained above water level. When the pier had been continued in this manner to the requisite height, the top was corbeled to receive the granite masonry forming the superstructure of the pier. To insure the pier maintaining an even keel during the attachment of the masonry, building was carried out symmetrically, and the parts filling out at the ends were subsequently removed.

This method of construction was carried on until the bottom of the piers had sunk to a depth leaving only a space of about 12 inches between the under surface of the bottoms and the face of the foundations, which were ready to receive them. The piers were then towed into position above the foundations, and slowly lowered until the iron ring girders of the piers bore upon the surfaces of the foundations. Divers then descended to see that the piers were in correct position, and drove wooden wedges between the rims of the plates of the bottoms and the foundations, and completed the clay packing all round to secure a water-tight joint. When this was done, the bottom of the pier was attached to its foundations by grouting with pure dissolved cement.

The movable leaves have a total length of 109 feet between centers, while the fixed spans, which are of the ordinary plate-girder pattern, have a length of 55 feet. The movable spans are constructed in accordance with the well-known Strauss trunnion bascule principles. The counterweight, when the spans are down, rests in a position high above the roadway in the towers, being pivotally carried on two legs on pins in the tail ends of the leaves, the movement of the counterweight above being controlled by the usual links constituting the characteristic parallel motion of the Strauss design. As the leaf rises the counterweight descends toward the roadway, finally disappearing into a pit, when the limit of the upward travel of the span is reached. The equipoise of the leaf and its counterweight during this movement is dependent on the four axes of rotation, viz.: the axle of the platform; the coun-

BASCULE BRIDGE AT COPENHAGEN, DENMARK.

terweight's leg point of support on the tail end of the leaf; the axis of rotation of the guiding member on the counterweight, and the fixed axis of rotation of the guiding member on the tower structure, lying in the angles of a parallelogram.

The advantage of this arrangement is that the length of the tail ends may be considerably reduced, and space rendered available for a large heavy counterweight.

The weight of each of the leaves of the bridge is 146 tons, and the counterweights weigh 247 tons.

In order to eliminate all vibration arising from traffic, the bridge has been constructed in such a manner that the leaves are locked against each other by hinges in the upper part of the top chords, while the pressure is transferred to abutment hinges on trestles in the piers.

The first operation in raising the bascules is the lowering of the counterweights upon the tail ends, so that they counterbalance the weight of the leaves. This is carried out hydraulically. The leaves are then raised by means of electrically-driven gearing.

Each of the leaf girders carries a spur gear meshing with a series of fixed pinions, and vertical shafts extending through the columns of the towers.

When the bascules have been lowered again to their correct position, the pressure of the counterweights on the tail ends of each leaf is removed by hydraulic pistons, which lift the legs of the counterweights until they cease to bear upon the tail ends of the span. The mechanical action of raising and lowering each leaf is carried out by means of two 54-horse-power 450-revolution electric motors, one in each tower. About 13 kilowatts is expended in the raising and lowering of both leaves, and the time occupied in either raising or lowering the bascules is about 25 seconds, the same time being occupied in removing the pressure of the counterweights from the tail ends.

When steamers are passing the bridge traffic is stopped for about two to three minutes. The bridge carries two tracks for the electric surface tramway; its bascule section has a roadway of 22 feet 6 inches, opening out on the fixed spans for the convenience of the traffic. On either side of the bascule section is a sidewalk 11 feet 2 inches wide; on the fixed spans this sidewalk has a width of 13 feet 8 inches. The cost of the whole structure amounts to about $280,000 and the work was carried out under the supervision of Mr. H. C. V. Moller, chief engineer to the Copenhagen Harbor Board.

SOME EXAMPLES OF STREET DESIGN.

THE accompanying photographs, for which we are indebted to Robert J. Harding, superintendent of public works, Poughkeepsie, N. Y., continue the series of examples of street design which was begun in the September number of MUNICIPAL ENGINEERING. Not all of these designs are good, but

they are all shown as constructed, and their points of excellence and their defects can readily be discerned.

Plate I is a view of Franklin avenue, Columbus, O., which is a street on a rather heavy grade, paved with asphalt, with wide brick gutters and Berea sandstone curb. It illustrates a street similar to that described in the Question Department on another page, and gives some hint of the improvement in appearance of houses on account of their position of elevation above the street pavement. This particular view does not show all the advantages because the sidewalk is not yet laid, the bank along the property line is not yet graded to its proper slope and sodded, and there are no trees. There are indications that the street is to be a residence street, with comparatively little traffic, and the appearance of the street would be much improved by narrowing the paved roadway and thus giving space for a lawn either next the curb or next the property line, in which trees could be set.

Plate II shows Sixty-sixth street, in Cleveland, O., with brick pavement, Ohio sandstone curb twenty years old and cast iron telephone poles carrying the wires above the trees. This street is older and shows some good trees, although their irregularity indicates the need of proper supervision of planting and protection. This street is also cut well down below the general level of the ground, and the necessary slopes are well divided between the lawn lying between curb and sidewalk and the lawn inside the property line. Too much of the slope should not be put into the space next the curb, otherwise the sidewalk will slope down too rapidly to the curb at the end of the block, or it will be necessary to put in steps, as shown in Plate VI, on page 171 of the September number, a treatment which should be reserved for those places where nothing else will serve.

Plate III, a macadam street in Geneva, N. Y., shows how the sidewalks may be sloped down to the curb at the street intersections in case part of the slope due to the cutting down of the roadway is thrown into the lawn next the curb. The property on one side of the street is higher than on the other and the street is cut down below the property line on the lower side. This street is not yet finished, but its design gives promise of great beauty when lawns are sodded, the missing trees are put in, some of the superfluous poles are removed, and handsome electric light standards are substituted for the primitive arms such as are shown in the photograph. The proportion of roadway to lawns and sidewalks is particularly to be commended.

Plate IV shows a macadam street in Geneva, N. Y., under construction, the design of which is also to be highly commended. In this case, also, the street has been cut down to and even below the property on the lower side, although it is necessary to leave the sidewalk on the upper side well above the curb. This could not have been done so well if the roadway had not been narrowed. It is evidently not possible to grade the sidewalks on the upper side down to the curb level without destroying the trees, and when the lawn is properly graded and sodded it will be much handsomer in its present location than if so graded down.

Plate V shows Hudson street, Ithaca, N. Y., a macadam street with a deeply hollowed concrete gutter, to carry the surface water with as little danger of washing the macadam as possible. As shown in the picture this is not a very satisfactory solution of the problem presented. Unless the street has a large amount of through traffic, the roadway might well be narrowed materially, thus giving a lawn on the lower slope more nearly suited to the size of the trees and permitting the formation of a gentler slope on the upper side, so that the trees would have less appearance of instability on account of undercutting. The residences are very close to the street line, but much improvement could be made if the owners would co-operate and follow a plan made for the street as a whole, rather than retain the present miscellaneous collection of walls, fences and slopes of various grades and methods of cultivation.

Plate VI, East Seneca street, Ithaca, N. Y., looks better because there happens to be more lawn and the reduction of gradient in the road did not demand so deep a cut in the road. This street could be improved in appearance by narrowing the roadway and reducing its crown, which is probably at a higher elevation than the sidewalks on the lower side, but it is a handsome street as it stands.

The effect of building a street on the level of the surrounding ground is shown in Plate V, on page 171 of the September number. The houses and the schoolhouse appear to be low and liable to take the drainage from the street, or certainly not to be drained by the street, and the effect of this is certainly not pleasant, not to speak of the other faults in the design and maintenance of the street.

I. FRANKLIN AVENUE, CLEVELAND, O.

II. SIXTY-SIXTH STREET, CLEVELAND, O.

COUNTY HIGHWAYS.*

By James M. Head, Ex-Mayor of Nashville, Tenn.

BEFORE proceeding to discuss the particular branch of the subject to which I desire especially to address myself, there are certain fundamental propositions which I wish to state with all the emphasis that I can command.

First and most important of these propositions is this: That the building of good roads for the free use of all the people is one of the highest and most important functions of government, the one which has been most neglected and the most abused whenever it has been attempted to be exercised.

Second, that good roads cannot be built without the expenditure of large amounts of money.

Third, that this money cannot be intelligently expended without the employment of the very best engineering talent that can be found.

And fourth, that whatever amount is expended should be upon some well-defined plan as a whole, and not as so much patch-work, to be repeated every year and then leave the roads in no better condition than when commenced.

It is true that when the Constitution of the United States was adopted and the power expressly conferred upon Congress to establish postoffices and post roads, the present methods of transportation and communication were never dreamed of, but the power, having been expressly conferred, those entrusted with its administration should have had the courage to exercise that power in such a manner as would meet those conditions when they did arise, and at the same time best serve the interest of the whole public. This they have not done or attempted to do, and the several States, instead of taking up this burden, which the federal government has neglected until within the last few years, have undertaken to lease out to private corporations, to be exercised for private gain, one of the highest, most important and sacred functions of government—the duty of providing good roads for the free and untrammeled communication and transportation of all the people and their products. We are now, therefore, confronted with a situation which demands heroic action, in order to meet these conditions and prevent them from growing continually worse.

If this convention can do no more than succeed in firmly establishing in the public mind the fact that good roads cannot be built without the expenditure of large amounts of money, which must be provided either by the people as a whole or by the property specially benefitted; that this money cannot be intelligently expended without the employment of the most skilled engineers, and that some well-defined system of road building must be adopted for the whole State before anything worthy the name of good roads can be undertaken, then it will have more than fulfilled the purpose for which it was called.

Until the people of this State get it thoroughly out of their heads that good roads can be built by "warning in" the neighbors for a few days' frolic at so-called road building; that no local boss can properly lay out or construct a good country road; or that a little patch-work, to make the road passable for a time, will ever result in any system of good roads, you never can and never will have any roads worthy the good name of the State in which you live. I wish to say in this connection that the policy of requiring poor devils who own neither horses nor vehicles to give six days of their time—which is all they have—to work on public roads for the benefit of property owners, is a disgrace to our civilization and a relic of feudalism which should long since have been abandoned.

Whether or not this proposed general system of road building must be under the exclusive control of the federal government, under its express grant of power to establish postoffices and post roads, or whether it must be left to the several counties and cities and civil districts to putter along as they have done in the past, is a question which should be decided at as early a day as possible. As for myself, I believe there should be co-operation between the federal and State governments, and that counties, cities and districts should be made to conform to these general pains.

I know this may be looked upon as paternalistic and tending too much to-

*A paper before a Tennessee Highway Convention.

III. MACADAM STREET IN GENEVA, N. Y.

IV. MACADAM STREET IN GENEVA, N. Y.,
Under Construction.

wards centralization, but we may as well realize now as later that there are certain functions which the federal and State governments can very much better perform than the local authorities, and that when this is the case, the service of the public should not be sacrificed for a mere sentiment, which has no substance back of it.

It is too often the case that those who protest the loudest against paternalism in government are themselves the servants of a corporate-owned, boss-controlled political organization, more paternalistic in its methods than any governmental function against which they protest so loudly, and that it is the service of this party rather than the public good at which they aim.

Be this as it may, it cannot be denied that the building of good roads, the regulation and establishment of means of transportation, is one of the original functions of government which was directly conferred upon Congress, and which it should now exercise for the benefit of the whole people and not in the interest of a favorite few.

In this connection it might be well to allude to the fact that Great Britain is now about to adopt the French policy of building roads and improving streets by creating a highway commission, with full power and authority to lay out and build public highways, and to condemn and purchase or charge the cost against lands on both sides for such a distance that when the road is built it can be sold at a sufficiently increased price to pay the entire cost of building the road. The plan is worth our serious consideration, and sooner or later it may have to be adopted.

In practically all of the large cities throughout the country the plan of assessing a part, or as some cities do, all the costs, of improving the streets, not to exceed, however, the benefits conferred, upon the property abutting upon the street to be improved, has been adopted, and there is no valid reason why the same rule should not be applied in building country roads, especially where a great state improvement like that outlined by your governor of building a thoroughfare from one end of the State to the other is undertaken. If the building of such a road actually benefits and increases the value of the land along its line, as it undoubtedly would, there is no reason why the parties who receive this benefit should not be called upon to pay a portion of the cost of this improvement, at least to the extent that the land has been benefited.

But I have digressed from what was intended as the main purpose of this paper—a discussion of the importance of the mineral aggregate and the cementing material used in road building.

For nearly one hundred years we have been building the ordinary macadam roadway as the standard for country roads, boulevards and light traveled streets, but the advent of the automobile within the past ten years has demonstrated its manifest unfitness for further use where this character of traffic must be provided for.

That the automobile has come to stay, for the transportation of both people and merchandise, is now no longer a question of doubt, and the road builder may as well govern himself accordingly. Already the Massachusetts Highway Commission has reported that more than 40 per cent. of the traffic over the state roads is now carried on by horseless vehicles.

Laws regulating the speed of automobiles will not suffice. The road must be built to withstand the traffic which the public demands, and you may rest assured that the public will demand the best and quickest transportation that can be had.

The building of roads, like everything else, must grow and improve, in order to conform to the changed conditions which it is expected to meet. From the ox-cart to the automobile, and from the bridle path through the mountains to the latest improved boulevard through our parks, the growth of the improvement in the roadway has in a measure tried to keep pace with the improvement in the methods of transportation, but today we are confronted with a proposition which renders a radical change in the method of constructing our roadways essential.

During the past few years many experiments have been made to construct a roadway, at a reasonable cost, that would withstand the action of the elements, water, heat and frost, the impact of the horses' iron-shod hoof, the grinding effect of the wheels of traffic or the sucking action of the automobile tire in withdrawing the cementing material and scattering it to the winds, created by the speed of the machine itself. And while all of these experiments lead to the conclusion that the use of some bituminous binder is absolutely necessary to meet these conditions, the perfect roadway has not yet been devised.

V. HUDSON STREET, ITHACA, N. Y.

VI. EAST SENECA STREET, ITHACA, N. Y.

In all these experiments there have been two radically different theories as to the best method of constructing a roadway that would bind the mineral particles together, afford elasticity and waterproof the surface so as to make the roadway withstand the action of the elements and the strain of traffic—the one theory assuming that mere density of structure would best accomplish this end, and therefore advocating the use of fine particles of sand so graded as, with the bituminous cement used, to make, as nearly as possible, a solid mass, depending, however, almost exclusively upon the cement used to furnish the required hardness to withstand the effect of traffic. The other theory claimed that greater stability, and at the same time greater density, could be accomplished by the use of different sizes of stone so graded that the smaller would fill the voids between the larger, and thereby permit the use of a softer cement, giving to the structure greater life and elasticity, and at the same time affording a better foothold for horses and prevent the skidding of automobiles.

In additions to these radical differences in the construction of the more permanent street structures, there have also been various efforts at more temporary and cheaper forms of construction, still, however, using some form of bituminous cement by surface application or percolation methods of introducing it into the wearing surface of the roadway.

All of these latter methods are necessarily temporary in their natures, require frequent application, and while more or less expensive, are not so expensive as either of the more permanent methods of construction, which require expensive plants, the careful selection and heating the materials, their combination in proper proportions, and great care in handling the material in the actual construction of the pavement.

But it does seem that there must be an intermediate method of constructing country roads. which will combine the essential ideas of the more permanent forms of street construction, without the expensive details necessary for the construction of that kind of pavement, and at the same time meet the demands to which the road may be subjected. And it is this form of road construction that I desire to submit for your consideration.

First and foremost in road building, as in everything else, there must be a good solid foundation properly laid out and constructed, before anything worthy of being called a good road can be commenced. Upon the subgrade properly graded and rolled a foundation not less than five inches of stone, of practically uniform size, not larger than 2½ inches, should be spread and thoroughly rolled, and upon this surface there should then be spread enough crusher screenings to fill the voids in the surface of the lower layer. If larger stones are used they should be placed in layers at the bottom. And if upon this surface, after thorough compression, there should be spread a bituminous compound of coal tar or asphalt and varying sizes of crushed stone mixed in such proportions as to give the highest possible degree of density, applied while hot, and before cooling again cover this surface with a coating of bituminous cement and ¼-inch stone chips thoroughly worked into this bituminous coating, a substantial, durable, smooth, waterproof and elastic structure can be produced at a reasonable cost, that will withstand not only the automobile but the average country traffic, be free from dust and afford easy traction, with a good foothold for horses. While more expensive than the ordinary macadam, such a road can be built at much less expense than asphalt, bitulithic, brick or any form of block pavement which is used in cities, and should be well within the reach of any community desiring to build a permanent and intelligent system of good roads. If only a few miles of this character of road was built each year, in a comparatively short time a good system of roads would be established and the desire created in every community to follow the same example.

It may not be improper for me to say in this connection that the form of construction which I have recommended for the country road is simply the standard macadam construction, supplemented by the use of a bituminous cement combined with crushed stone to waterproof the surface, fill the pores and protect the road from its worst enemies—water, heat and frost and the automobile. Merely having bituminous cement covered with crusher screenings over the macadam foundation would be an immense help and be less expensive, but would require frequent reapplication of the bituminous cement.

It has been said that at least 90 per cent. of the damage done to the roads of the country is done by the action of the elements, that the remainder

of the damage is done by the iron-shod hoofs of horses pounding and gouging into the surface, and that the wheels of vehicles, when not too narrow, or the vehicles too heavily loaded, did more to preserve than injure the roads. This was no doubt largely true before the advent of the automobile, but with its elastic wheel sucking from the surface of the road the fine particles of sand and dust which served as the only cement to hold the larger particles of stone in place, a new element of destruction to good roads has come to be reckoned with, and that road builder who does not take this fact into account when he comes to build the roads of the future will soon find himself counted with that most useless class of individuals, the "has beens."

There is one other fact in this connection which is easily the subject of demonstration, to which I desire to call your attention, and that is that if in the construction of the wearing surface of a road particles of broken stone, or even fine sand of a uniform size, are used, the percentage of voids into which water will come is from 44 to 50 per cent.

In other words, if you take a given measure and fill it with broken stone of uniform size, whether it be stone of two inches in diameter or fine sand, you can still pour into that vessel about 45 per cent. of water. But if different sizes of stone, sand and dust are used in the proper proportions, the voids in the mineral aggregate may be reduced below 10 per cent., and if these remaining voids are then filled with some bituminous cementing material, a practically solid and yet elastic structure can be produced, which will withstand for a considerable time both the impact of the horses' hoofs and the suction of the automobile; but without some such construction as above outlined the country road will continue in the future as it has in the past the stumbling-block to all real progress and the one reason above all others which makes country life so objectionable, and drives so many of our young people to seek employment in the cities.

MUNICIPAL GAS PLANT EXPERIENCES.*

By C. E. Moore, C. E., Santa Clara, Cal.

THE town of Santa Clara has one of the two municipal gas plants on the Pacific Coast, so far as known to the writer. There is nothing remarkable about this plant except the fact of its being owned and managed by the municipality. The writer has for several years been acting as consulting engineer for the town, and as such had charge of the construction of the water and electric plants which preceded the gas plant. When gas was taken up it naturally followed that the same arrangement was carried into that. Therefore it will be understood that the engineer as well as the town council had much of the gas business to learn, and that the writer of this does not assume to be an expert in gas matters. However, having been identified with the enterprise since its establishment, and continuing at present to be in touch with it, and since the plant occupies rather a unique position, it has seemed that a brief account of its career may be of interest.

The account will naturally fall somewhat into the lines of a discussion of municipal ownership, but this will not be with the object of establishing any extreme views, but rather with the idea of drawing such inferences as are possible from our experience. Regarding the broader question of general municipal ownership, the writer has come in contact with it in many other places and inevitably his views are somewhat colored by the sum total of all this experience, but the effort will be here to confine deductions as strictly as possible to those following from this case.

To make the situation clear, it will be necessary to first state in a brief way the cause which led up to this particular municipal ownership. Twelve years ago the town of Santa Clara took up the ownership of water supply. For this there were several powerful reasons, the chief one, perhaps, being the necessity for better fire protection. This plant was successful from the start.

There was also a desire for a more extended system of street lighting, and it seemed advisable to take that up in connection with the water plant. This plant was installed ten years ago. It

*A paper before the California Gas Association.

also was satisfactory, and the people came to have considerable pride in the plants. Every town, like an individual, likes to have something to talk about, and the municipal plants came to be the thing to talk about in Santa Clara. The matter now passed beyond the case of necessity, and the later movements along this line have been largely the result of the impetus of the idea. Municipal ownership became a specialty. Commercial electric lighting was taken up by buying the property of the electric lighting company, remodeling and extending the system and combining it with the street lighting.

Current for this purpose was formerly generated by the town, but for several years past has been bought from the San Jose Light and Power Co., and it is supplied by the Standard long-distance transmission lines.

Gas has been supplied by the San Jose Gas Company (later the Light and Power Company), for many years, by a pipe line from their works. The condition of the town has been such that there had been little encouragement for the company to extend their lines. There had been no special effort to push the business, and the consumption was only 10,000 feet per day. However, with the coming of renewed life to the town there began to be felt a desire for more extended service. Chiefly the development of the gas plant may be considered as due to the idea which had taken root. There was no particular dissatisfaction with the company, and the movement was entirely devoid of enmity to it. Accordingly all the property of the company in the town was purchased at a valuation made by an expert agreed upon by both parties. The transaction was amicable and satisfactory throughout.

There has since been considerable consumption (chiefly for fuel purposes), and the output at present is 35,000 per day. The price of gas was at first fixed at $1.75 per thousand, that being the price charged by the gas company. Later for service in San Jose the company made the rate $1.50, but no reduction was then made by the town. Still later the company reduced the rate to $1.25, when the town followed with a reduction to $1.50. That is to say, the town has in the matter of rates made no reduction until virtually forced to do so by the company. Of course there is no direct competition between the two, but inasmuch as they serve adjoining territory, it is in practice difficult to maintain much higher rate in one than in the other. It will perhaps be apparent from the foregoing that an attempt has been made to manage the plant on business principles, and not to be carried away by any popular idea that something could be got for nothing.

About 10,000 feet of pipe was taken over from the company. Since that time there has been laid about 50,000 feet.

It has been necessary to do the work largely with unskilled labor. At the beginning the work done in remodeling the distribution system was from necessity advertised. The contractor who took the work was not accustomed to laying the pipe. The blocks in many cases have very little fall, barely enough for surface drainage. Under these circumstances the writer put in force a system of laying to grades previously established by levels, and this system has been followed for extensions. This is done so simply, with so little trouble, and with such good results from entirely unskilled labor in grading the trench, that it would seem good policy for any company working in a flat country to follow the same system. In the old pipes, laid in the old way, with a spirit level, there have been frequent stops and stoppages. In the new mains there have not been any at all. The number of drips is by this system kept small, and these are located at convenient points. It may be that some gas companies use similar methods, but so far as I know they generally do not. The exact methods used had previously been developed on sewer work. Now as to the conclusions which may be drawn from our experience:

First, the plant and business needs continual and watchful care. In our case the care has been provided, and consequently the business has been successful. It has been very fortunate that there have been few changes of officials. The office of President of the Board, or Mayor, during all this time has not changed. The chairman of the water and light committee also is an old-timer, and has from the first been identified with the business. Questions of policy have been given careful consideration; just as careful as though it had been their own business. The result has been a good profit, but it is very easy to see how the balance might have been the other way. This is the chief danger that confronts any scheme of municipal ownership, namely, that men of ability may not be willing to give their attention to the town's business, or that the people will

not have the good sense to keep that sort of men at the head of affairs.

Second, as to the ability to meet emergencies. We had an experience of this kind growing out of the partial wrecking of all plants by the earthquake. This rests upon the men and not upon the system. In our case we feel that we have no cause for regret, inasmuch as water was supplied in about 24 hours, and gas in three days. This goes back to the first question of management.

Third, the ability to provide extensions.

In this particular the municipality is decidedly at a disadvantage. Whereas, a company can in this case borrow money to meet a large increase in the demands upon it, a municipality can not do this except by a bond issue, which cannot be resorted to in all cases. Consequently it is necessary to look well ahead and provide far in advance for such extensions of magnitude as are likely to be necessary.

Fourth, as to the attitude of customers. In these matters we are dealing not only with gas but with human nature, and this is practically the same the world over. There is an occasional demand for lower rates, in the case of the town, as there would be with a company. There is the same distrust of meters. About half the consumers consider the collector and meter reader to be their natural enemy. The people's pride in the plant is chiefly in the abstract, and does not particularly affect their attitude toward bills, and service. And yet it is not quite fair to let the question go at that, for there is a certain amount of feeling of individual ownership, which probably makes the conduct of these matters a trifle smoother than in ordinary cases.

Fifth, general conclusions.

The conviction of the writer is that no municipality should be advised to undertake the management of plants for the sake of profit, solely, as an individual or company may do. There should in general be other and stronger reasons. In the case of water, there often are such reasons. As we leave water supply and look along the line of other utilities, we find that in general these causes have less force. This does not mean that gas should be supplied at cost. In the first place, in a developing community extensions and increased facilities in every way are certain to be needed. If gas is supplied at cost all this must be accomplished by taxation.

Secondly, the question of exact cost is a precarious one at best. It must include all unexpected and emergency expenses and can really only be determined after a long term of years.

The probability is that selling at a cost determined from ordinary expenses would finally result in the plant requiring support from other resources of the town.

A NEW JERSEY ROAD.

EDITORIAL COMMENT

Accelerated Tests of the Effect of Automobile Traffic on Roadways.

Local Municipal Publications

ACCELERATED TESTS OF THE EFFECT OF AUTOMOBILE TRAFFIC ON ROADWAYS.

Quite a number of tests have now been made of the effects of automobile traffic upon highways from which some valuable information has been obtained. These tests have most of them been made under the conditions of regular traffic and so complete reports regarding the results have not been possible except in the case of plain macadam or roads subjected to the lighter treatments, which are mainly intended to lay the dust and thus prevent the removal of as much of this fine material as possible from the road by the automobile wheels and the rush of air which they produce.

Not long ago a report was made of a concentrated traffic test of a macadam road in Germany connecting the two ends of a railway tunnel which had caved in, and so subject to the heavy traffic of transferring passengers across the hill. Heavy motor busses, making together 80 to 140 trips a day, added to the crowd of local vehicles engaged in the transfer soon formed ruts which practically wore the pavement out in five months, necessitating the expenditure of some $2,000 a mile for maintenance during that time, although steady freezing weather for about six weeks served to preserve the road for that time. Although the speed of the motors was but 6 to 15 miles an hour, they picked up the small stones in the surfacing, thus producing the ruts.

Another concentrated traffic test, this time of a bituminous macadam road, was made last spring on the Indianapolis speedway, which carries some interesting lessons, although no careful observations have been made of the exact occurrences and their effects. A recent inspection indicates that the roadway was made of broken stone treated with a bituminous material, either tar or an oil asphalt, and it was apparently constructed in a manner similar to other bituminized macadam roads which have been successful under ordinary traffic.

A motor-cycle meet, held before the track was ready for use, was a failure, in part because the roadway became shortly too rough for the motors to travel over it safely. But at the beginning of the automobile races the track was most of it in fair to good condition. Four days of racing with anywhere up to a dozen cars running at top speed, ending each day with a race of from 100 to 300 miles, put the track entirely out of commission, so that the last race, 300 miles, was stopped before it was fully run out.

Those present at the races reported that on the stretches of the 2½-mile track which were distant from the grandstands the track became very dusty, and that those near the stands were kept clear of dust only by frequent applications of oil even while the races were in progress.

The recent inspection showed the same formation of ruts which was reported at the time of the races and which was reported on the German macadam road. The formation of dust on the outer reaches shows the tendency of the rapidly moving cars to pick up the material out of the roadway and of the rush of air about the cars to carry it away. The tendency of the cars to travel in a rather restricted band near the inner side of the track emphasized the formation of the resulting ruts there, although on the sections inspected there were ruts in more than half the width of the track.

The concentration here was of two kinds. First, the number of cars passing per hour was large. and second,

the rate at which they were traveling was excessive.

The observations of the effects of speed upon the action of automobiles in tearing up untreated macadam roads have shown, according to various observers, that speeds of 15 to 25 miles an hour will not injure dustless macadam roads, the maximum safe speed probably depending somewhat upon the character of the material and the method of laying it, particularly with respect to compacting it and cementing the wearing surface together. Undoubtedly the application of oil or light tar in dust laying will increase somewhat the speed at which automobiles can travel without injury to the roadway and the application of tar in the construction allows still greater increase, but the speed of the machines in an automobile race is demonstrated to be too great for this sort of surface.

It will be interesting to know whether the harder pavements, bitulithic, asphalt, wood or brick, are adapted to the pavement of an automobile race course.

No definite reports have been published regarding the success of the pavements of automobile courses made of concrete, but they have certainly not demonstrated their adaptability to the very trying conditions.

If the plans of the managers of the Indianapolis speedway are carried through on time, we will shortly have some knowledge of the value of brick for an automobile race course, for the speedway is now in process of paving with Culver block under the specifications and inspection of the National Paving Brick Manufacturers Association, with the exception that the former bituminous macadam pavement is used as the foundation, being brought to a uniform surface with crushed stone screenings and sand. The sand cushion and cement filler are put in strictly according to the most approved method and it hardly seems possible that automobiles at any speed could displace any part of the surface.

The writer is not informed as to the method of computing or determining the form of the cross section of the pavement, especially on curves, nor has he heard any adverse criticism of that adopted for the bituminous macadam surface. The new surface is apparently parallel with the old one, and the question will arise, whether the coefficient of friction is as great on the brick surface and whether the machines will be as well able to hold their courses upon the smoother and probably more slippery surface of the brick pavement.

It will take a year or two to test the method of construction as to provision for expansion, creeping on the steep slopes of the turns, stability of concrete curbs, etc. Meantime, a most excellent brick pavement is in process of construction at a minimum of cost, and, whether or not it proves to be a success as a pavement for an automobile race course, it will show to many people who would otherwise not hear of brick as a country road material, that it is a good and a reasonably cheap surfacing for the best traveled country roads.

LOCAL MUNICIPAL PUBLICATIONS.

There is this year quite an epidemic of publications, issued weekly or monthly in most cases, whose object is to report the transactions of the local municipal authorities or to discuss local municipal questions. Some of these are official publications, some are prepared by civic organizations of one sort or another or have their backing, and some are private enterprises. Many of them reach this office and it may be of interest to officials in other cities to know what is done in this regard and the success which is observed.

Undoubtedly the oldest is *The City Record*, of New York City, a daily now in its thirty-seventh volume, whose 11,111th number will be issued early in November. It is published under charter authority by the Board of City Record, consisting of the mayor, corporation counsel and comptroller, with Patrick J. Tracy as supervisor. In so large a city as New York, having such

a variety of industries, of official boards and employes, it is hardly possible to produce anything more than a daily record of transactions of individuals, boards and departments, advertisements of ordinances put in force, contracts to be let, condemnation proceedings and like legal notices. Occasional special supplements give the civil list, official canvass of votes, registry and enrollment lists, annual assessed valuation of real estate, law and finance department supplements. The paper has an annual subscription rate of $9.30 a year, and has a large subscription list. Recent numbers run from 24 to 104 pages, 9½ by 14½ inches, their number depending on the matter ready to print. They contain extracts from proceedings of the Board of Estimate and Apportionment, the Law Department (a weekly report of transactions), Department of Correction, Aqueduct Commission, Board of Water Supply, Public Service Commission of the First District, Board of Education, Department of Finance (weekly), Hospital Trustees, police, fire and building departments of the various boroughs, Board of Aldermen, Department of Public Charities, City Chamberlain, Commissioners of Sinking Funds, Board of Health, Civil Service Commission, etc., reports of presidents of boroughs of transactions of the departments under their charge; announcements of changes in department officials and employes, papers aside from the *Record* itself, in which official advertisements appear, notices of bids to be received by various departments, of examinations by the Municipal Civil Service Commission, of assessment lists prepared, of public hearings, sales of corporate property, of consideration of contracts and franchises, of changes in city map of various sorts, of Supreme Court proceedings on city matters, as well as standing general information of daily use. Some of the reports are two months or more late in appearing. It is hardly possible in a publication so devoted to detail to have any system of classification and correlation which would serve any permanent purpose, especially since anything of this sort would require a number of editors expert in law, finance, engineering, government and the many departmental subdivisions. It is assumed that the facts are printed and the citizen must dig them out.

Next in point of age of the official papers is the *Municipal Record* of the city and county of San Francisco. Before the fire the *Merchants' Association Review*, published by that body, was the only permanent medium for keeping citizens informed of civic movements, and this was unofficial and devoted mainly to the efforts of private citizens and civic organizations to improve the conditions under the city government. This publication was stopped by the fire. Since the investigations of the methods of official management, made last year, the city has published the weekly paper named above, beginning with the number for October 8, 1908. It prints the monthly, weekly and occasional reports of various departments, such as sewer cleaning, street repair, city engineer, city architect, street sweeping and sprinkling, permits and contracts granted, proceedings of boards and commissions in summary. These last are reported in newspaper rather than official style, saving space and presenting the matters considered important by the writer, in language giving his understanding of their purport. These have a tendency to become perfunctory, especially where considerable detail is considered advisable. Each number contains also a general description, usually with an illustration, of some important work or project. As examples may be noted several articles on the new water supply and the question of municipal ownership with illustrations and descriptions of the new sources of supply, report of committee on garbage disposal, descriptions of the municipal asphalt plant, school buildings, fire engine houses, libraries, proposed or completed, hospitals, courthouse, repair department, police department review, health department laboratory, launching of fire boat, pictures of the world's great civic centers, reprinted from Denver *Municipal Facts*, high-pressure pumping

engine and pipe-laying. Most of these special articles were published in the numbers of the first six months, and most of the numbers of the present year are restricted to the official record. This is quite comprehensive, but is not so thorough as the New York paper. The paper is distributed at the department offices or mailed on request without charge. It has no official advertisements and is apparently not complete in announcing times of receiving bids and hearing causes before the various departments.

Since February, 1909, *Denver Municipal Facts* has been published and distributed weekly, without charge, for the purpose of furnishing information concerning municipal affairs. This publication is more of a newspaper in its treatment of its subjects, and, while it has a collection of news items from official sources concerning the city highways, parks, building, health, fire and police departments, and occasional reports of council proceedings, and maps of assessment districts for various improvements, most of its space is devoted to brief and very readable articles, well illustrated, concerning the endless variety of municipal improvements which have been made, are in progress, in contemplation or in the dim future. The most notable departments appearing regularly, aside from the official news, are those headed "What Other Cities Are Doing," the series of illustrations of the world's great civic centers, "Letters of Public Interest," most of them commendatory of the publication. The many illustrated articles on methods and results in Denver municipal progress show in interesting form what the city is doing, and the compiler of the paper, as he is styled, is an adept in making his paper attractive to the general reader. It is an excellent advertisement of the city administration to the citizens and an excellent advertiser of the city to outsiders. The searcher for technical details will also find his demands reasonably well met, though he would doubtless find it necessary to go to the department records and reports for complete information. There is no complete announcement of contracts to be let.

The Boston *City Record* began publications August 14, 1909. It is published weekly by the Statistics Department and has a subscription price of $1 a year. The department has published monthly, quarterly, annual and occasional bulletins giving tabular statements of statistics of Boston and occasionally of other Massachusetts cities, ever since it was established some ten or eleven years ago. The new publication has a wider field and under the law must publish all legal advertisements of the city departments, awards of contracts, appointments and changes in men and salaries. The departments required to advertise lettings, etc., are charged advertising rates. The numbers thus far issued contain from eight to forty pages. The regular departments include a standing directory of the municipal service, calendar of department and other meetings, hearings, etc.. department changes, contracts awarded, sale of materials, time table of municipal band concerts, official directory, reports of municipal construction work, and the official advertisements. Department expenditures, taxes and assessments, appropriations, a proposed high-pressure fire system, motion picture censorship, list of delinquent taxes, age statistics of municipal employes, proceedings of school committee, and of board of aldermen and common council, communications regarding better observance of Independence Day, state investigations started by the last legislature, bequests to the city, are some of the subjects also appearing. So far as the law extends this publication is in official form, i. e., in the regular departments, advertisements and proceedings of legislative bodies. Otherwise it follows rather the fashion of San Francisco, but with many communications from officials and citizens concerning projects and methods.

Philadelphia also publishes a *City Record*, and Houston, Tex., has *Progressive Houston*. The Chicago Bureau of Statistics publishes monthly, quarterly and annual bulletins of statistical tables, leaving out almost all of the financial statistics.

The Worcester, Mass., Board of

Trade publishes *The Worcester Magazine*, and with a subscription price of $1.50. It is a handsome exposition of trade conditions in Worcester, which gives considerable attention to civic improvement in all its branches. It is intended largely as an advertisment for the city and its numerous industries. It is in no sense official and pays but little if any attention to details of the city administration.

The Indianapolis Commercial Club published for a short time *The Commercial Club Monthly*, devoted to the interests of the club, but it has been discontinued and a new periodical with another name, *Forward*, is now in contemplation which will serve in part as an advertiser like the Worcester monthly, and in part as a record of municipal progress. There are several other publications of this nature, semi-public in ownership and aims.

Another class of publications properly coming under this heading is represented by *Pacific Outlook*, of Los Angeles, Cal., published weekly by a company at $1, and devoted wholly to municipal affairs. It expresses its opinions fearlessly upon all questions of municipal management and attacks what it believes to be detrimental to progress in the best sense. It is now in its seventh volume. A department of "Municipal Affairs" discusses briefly many topics bearing on municipal happenings in Los Angeles and other cities. "Los Angeles City Work and Legislation" is "an index review of all action by council, board of public works, commissions and officials, relating to property improvement or of general interest." "The City Beautiful" discusses the plans for civic beautifying. The paper may be classed as strictly local in character.

In the city of Memphis, Tenn., is published at $2 a year *Civic Affairs*, a local weekly which has just finished its first volume. It has one or two leading articles each week on municipal problems, a regular department of "Municipal News and Comment" about other cities and a little news about municipal happenings in Memphis, but makes no attempt to record official acts or projects. In a recent number its editor recommends the publication of a weekly journal by the city commissioners. The success of such papers as the last two named must depend upon the ability of the editor in serving the local demands and of the publisher in securing advertisements.

In Indianapolis is a daily paper, *The Indianapolis Commercial*, devoted to a brief record of municipal, county and court proceedings, and containing the legal advertisements of the city. It also publishes columns of abstracts of advertisements for bids by the city and county and other cities and counties in the State. Financial news also occupies some space. The subscription price is $5 a year, and advertising space is limited. It is financially successful, being about fifteen years old.

A new publication restricted to its State is the *Municipal Law Reporter*, devoted to the legal interests of the boroughs of Pennsylvania and published at Hanover, Pa., for $5 a year. It contains acts of the legislature affecting municipalities and abstracts of decisions of the courts in which municipal officials would be interested.

All these publications have their limitations, for it is difficult to find an editor, especially in an official family, who has at the same time the editorial skill and sense of fitness of his work for his audience and the expert knowledge of municipal affairs which would enable him to bring together all the material necessary, arrange it logically and put it in readable form, without at the same time injecting into it, consciously or unconsciously, personal or political bias. It is easy to point out improvements that could be made, but it is not easy to tell how to make them, or to find any one who can learn how to make them. The best advice that can be offered is that all parts of the problem be carefully and diligently studied and improvements be made as they are proved to be improvements. Perfunctory official attention will not bring the desired progress. *Denver Municipal Facts* has the most promise of improvement because it shows the most expert treatment of the case at the present stage of its progress.

THE QUESTION DEPARTMENT

Qualities of Sand-Lime Brick.

I am very desirous of obtaining information regarding the various physical and fire-resisting properties of sand-lime brick in comparison with clay brick. Can you supply me with such information?

J. A. S., Westfield, Mass.

MUNICIPAL ENGINEERING has a number of articles giving the information desired. To those listed in vol. xxxiii, p. 102, may be added one on "Physical Properties of Sand-Lime Brick" in vol. xxxiv, p. 307.

Makers of Tile for Engine Room Floors.

Please give names of firms from whom we can procure tiles for laying our engine room floor. SUBSCRIBER, Mankato, Minn.

Slate floor tile can be obtained from the dealers in slate or the quarries in Vermont, such as the Eureka Slate Quarries, Fair Haven, Vt., in Pennsylvania, such as Slatington Slate Co., Slatington, Pa., in Maine and Virginia.

Cement floor tile are made by manufacturers of cement products who have sidewalk block machines, such as the Waterloo Cement Machinery Corporation, Waterloo, Iowa.

Encaustic floor tile are made by many firms, including National Tile Co., Anderson, Ind., and U. S. Encaustic Tile Works, Indianapolis, Ind.

Floor or porch tile of vitrified red shale are made by the New York Press Brick Co., Rochester, N. Y.

Various kinds of floor tile are made by the American Encaustic Tiling Co., Zanesville, O., The Ludowici-Celadon Co., Chicago, Ill.

Sidewalk tile are made by the Wabash Clay Co., Veedersburg, Ind.

Vitreous floor tile are made by most of those above named, the Alhambra Tile Co., Newport, Ky., Mosaic Tile Co., Zanesville, O., and others.

Painting Concrete Blocks.

Will you kindly answer me the following question, through the question department of MUNICIPAL ENGINEERING? Is it necessary, before applying paint to the exterior face of a concrete block, to put on a prime coat of filler of some kind? And, if necessary, what would you suggest as the best?

W. A. H., Lee, Mass.

The first requirement in painting cement is that the material shall be dry. Moisture is essential to the hardening and setting of cement. It is not possible, therefore, to paint newly-made concrete or cement blocks with anything except cement or similar material, until the concrete has thoroughly cured, a process which should take two or three years. Unless, indeed, the concrete is dried out and the setting stopped, in which case it may never attain its full strength.

Again, oil paints are affected by the free lime almost always found in fresh concrete. This disappears in time, either by being washed out or by combining chemically with other substances in the mixture, or taken from the air or moisture reaching it. Age is a necessity, therefore, in making concrete ready for oil paint. The condition of age can be accelerated more or less successfully by various kinds of treatment, about which there is more or less difference of opinion.

Thus, some recommend washing the surface with a 7 to 8 per cent. solution of hydrochloric (muriatic) acid, thoroughly washing afterward with clean water, and then drying. Others say that the chemical action produces chloride of calcium, which is soluble and pits the surface, or, if covered by the paint, may gather moisture and blister the paint.

Others recommend similar treatment with dilute sulphuric acid, which is not subject to the same objection. But others say the action of the acid is too superficial to produce safe conditions.

Macnichol paints the cement surface with equal parts of water and sulphate of zinc and allows two or three days for drying before applying the paint. The changes are formation of insoluble sulphate of lime and oxide of zinc, the latter an ingredient of most white paints.

Bosse dissolves carbonate of ammonia in water and paints or sprays the surface with it, 10 pounds of the carbonate in 45 gallons of water being strong enough for a single coat, and weaker solutions requiring two or more. With lime mortar joints more will be found necessary than with cement mortar. The result is insoluble carbonate of lime, water and volatile ammonia.

A nearly white paint can be made of two parts of Portland cement and one of marble dust, which requires thorough wetting of the blocks immediately before applying. There are several proprietary paints of similar nature having a variety of colors, which are preferred by some to oil paints.

Books on Concrete Sewer Construction.

Will you kindly give us information as to where we can get a good book on build-

ing concrete sewers? We are doing some of that work now, and would like to look up on it a little.

I. F., Sioux Falls, S. D.

Gillette and Hill's "Concrete Construction Methods and Cost" ($5); Buel and Hill's "Reinforced Concrete" ($5); and Taylor and Thompson's "Concrete, Plain and Reinforced" ($5) all have chapters upon the construction of concrete sewers, both plain and reinforced. MUNICIPAL ENGINEERING has several articles describing methods of construction of concrete sewers, a list of which will be found in the July number, vol. xxxvii, p. 34.

Articles on Municipal Ownership.

A year or so ago you published a list of articles showing municipal ownership of lighting plants, etc., a failure. Can you refer me to the list?

H. C. M., White Hall, Ill.

The list referred to is probably that in vol. xxxiv, p. 163, which includes articles on both sides of the question. There are other lists of such articles in vol. xxxiv, p. 299, vol. xxvii, p. 273, and vol. xxi, p. 163.

The following articles giving some information on the subject have appeared since the above lists were printed:

"Cost of Operation of Municipal Light Plants," vol. xxxv, p. 35.

"Rates for Lighting and Contract Provisions," vol. xxxvi, p. 33.

"Will Electric Light Plant be Profitable?" vol. xxxvi, p. 241.

"Report Adverse to Municipal Lighting for Spokane, Wash., vol. xxxvi, p. 390.

"Municipal Street Lighting Plant," vol. xxxvi, p. 373.

"Terms for Renewal of Lighting Franchise," vol. xxxvii, p. 36.

Most of the numbers of MUNICIPAL ENGINEERING above named can be supplied at 25 cents each.

Cost of Electric Current.

Will you not kindly send me figures from twenty-five or more representative cities in the United States and Canada as to the cost of electric current for lighting, power, etc.? I should like to have the figures as late as I can—within a year or two. If they have appeared in a previous number of MUNICIPAL ENGINEERING, please send me the number and I shall be glad to remit the price.

I should like cost in kilowatt hours, and any flat lamp rates which may be in force. To be of greatest value the cities should run from 75,000 up.

J. W. B., St. Paul, Minn.

Following are the electric current rates in the cities of the United States between 75,000 and 125,000 population in 1906, according to the latest information on file in the office of MUNICIPAL ENGINEERING, the figures from cities in New York and Massachusetts being taken from the latest reports of the state commissions having charge of electric lighting corporations, and all the others, with one or two exceptions, being not older than 1905.

Springfield, Mass., uses the demand system of charging for electric current, with 15 cents per kilowatt-hour as the primary rate and 8 cents as the secondary rate, and a minimum charge of $1 per month and free renewals. The rates for power are 5 and 2 cents respectively. Flat rates for commercial service average about $3 per 16 candle-power lamp per year, and arc lamps cost $5 to $8 per month. Street lights cost $15 a year for incandescent lamps of 25, 40 and 50 candle-power, most of them the first named, and for 1,200 candle-power arc lights $73 a year if on overhead lines and $85 a year if on underground lines.

Troy, N. Y., charges for arc and incandescent lights, commercial service, by meter, 15 to 4.5 cents per kw. hr., according to amount used. The charge for power varies from 15 to 4 cents. The flat commercial rate for 2,000 c. p. arc lights is 40 to 29 cents per lamp per night. Public street lights cost 26 cents per night for open arc lights of 1,000 and 2,000 c. p., burning all night and every night.

New Bedford, Mass., has commercial meter rates for incandescent and arc lights of 15 to 10 c. per kw. h., and for power 12 to 4 c., with a discount of 5 per cent. for prompt payment, a minimum charge of 75 cents a month, and free renewals. The street lights cost $25.55 a year for 16 c. p. incandescents and $97.56 for 1,200 c. p. arcs averaging 10.6 hours per night for the year.

Kansas City, Kan., has a commercial meter rate of 10 c. per kw. hr. Street arc lights of 2,000 nominal c. p. cost $64.92 a year, and 25 c. p. incandescents cost $19.92.

Des Moines, Iowa, has a commercial meter rate of 7 to 14 c. per kw. hr. The street light contract has recently been extended at the rates of $65 a year for 2,000 c. p. arcs and $17.04 for 32 c. p. incandescents on an all-night schedule.

Lynn, Mass., has a commercial meter rate for lighting of 13 c. per kw. hr., and for power of 6 to 3.1 c., according to amount used. There is a discount on light bills of 2 c. if for over 72 and of 4 c. if over 285 for the month, and a discount of 1 c. for prompt payment. The minimum charges are 50 cents a month for light and $2 for power. Street lights cost $15.50 for 25 c. p. and $16 to $18 for 32 c. p. incandescents, and $94.90 for 2,000 c. p. arc lights per year, with all-night schedule.

Wilmington, Del., commercial rate for incandescent lights is 5 to 10 c. per kw. hr. Street lights cost $62.92 for 2,000 c. p. arc, and $14.68 for 24 c. p. incandescent lamps per year on all-night schedule.

Trenton, N. J., is served by the same company which serves Camden, N. J., and at the same rates.

Richmond, Va., has a commercial rate of 10 c. per kw. hr., with discounts. Street lights cost $54.75 a year for each 6.6 ampere arc light, all-night schedule.

Bridgeport, Conn., pays $83 a year for 1,200 c. p. arc street lights on all-night schedule.

Nashville, Tenn., has a municipal street lighting plant, and the cost per 2,000 c. p. arc light is reported to be $40 a year on all-night schedule. The records indicate that a private plant furnishes commercial arc lights at $60 to $144 per year and incandescent lights at 12 c. per kw. hr.

Camden, N. J., commercial incandescent light rate is 10 c. per kw. hr. Street lights cost $15 to $27 a year for incandescent and $85 to $109.50 for 2,000 c. p. arc lights.

Reading, Pa., has a commercial rate of 12 c. per kw. hr., with discounts of 5 to 60 per cent., according to amounts used. Street lights according to a late contract cost $78 a year for 2,000 c. p. arc and $19.20 for 20 c. p. incandescent lights.

Lowell, Mass., has a commercial rate for incandescent lights of 12 c. per kw. hr., which rate applies in residences for the first 50 hours' use per month, with a rate of 6 c. for additional current, and a minimum rate of $1.11 a month. The same rates apply to commercial arc lights, except that the minimum charge is $1.66 per lamp per month. The rate for power is 11 c. per kw. hr., with discounts of 5 to 56 per cent., according to amount used, and a minimum charge of $5.55 a month. Renewals are free to metered light customers, and there is 10 per cent. discount for prompt payment. Street lights cost $22.50 for 40 c. p. incandescent and $100 for 2,000 c. p. arc lights per year with all-night schedule.

Hartford, Conn., has commercial rates of 13 to 10 c. per kw. hr., with 5 per cent. discount for prompt payment. Street lights, according to the latest report at hand, cost $70 a year for 1,200 c. p. arcs and $18 for incandescents, with all-night schedule.

Albany, N. Y., has maximum meter rates for lighting of 15 c. per kw. hr. The rate for power is $60 per horse-power per year. Street lights cost 27 c. per 2,000 c. p. arc lamp per night with all-night schedule.

Cambridge, Mass., has a commercial lighting rate of 15 c. per kw. hr., and power rates of 10 to 2 c., according to amount used. Renewals are free. There is 10 per cent. discount for prompt payment, and an additional discount of 50 per cent. from the excess of bills over $50 a month. The minimum charge is $1 a month. Street lights cost $30 for 40 c. p. incandescents and $90 for 1,200 c. p. arcs per year, all-night schedule.

Grand Rapids, Mich., has a municipal street lighting plant, in which the operating charges are $35 to $40 per 2,000 c. p. lamp per year, and the total cost is $60 to $65, including all allowances. A private company furnishes commercial current at 12 to 6 c. per kw. hr., according to quantity, with 10 per cent. discount for prompt payment.

Dayton, O., is reported to pay $68.50 per year for 2,000 c. p. arc street lights on all-night schedule.

Seattle, Wash., has a commercial rate of 8 to 7 c. per kw. hr. Street lights cost $66 a year for 6 ampere, 72 volt, arc lamps, and $15 for 30 c. p. incandescents.

Atlanta, Ga., has a commercial rate of 12 c. per kw. hr. Street lights seem by the latest contract to cost $75 for 2,000 c. p. arcs and $33.75 for 75 c. p. incandescents per year on all-night schedule.

Fall River, Mass., has a commercial lighting rate of 15 c. per kw. hr. and a power rate of 10 c. per kw. hr., with discounts for prompt payment ranging from 5 per cent. on bills less than $5 to 40 per cent. on bills over $75 a month. Lamp renewals are free. Street lights, 4 ampere lamps, cost 25 c. per night, all-night schedule.

Portland, Ore., has a commercial arc flat rate of $180 per lamp per year. The meter rate is 15 to 5 c. per kw. hr., according to amount used, and there is 5 per cent. discount for prompt payment. Street lights by the latest contract seem to cost $63.60 for 2,000 c. p. arcs and $13.08 for 25 c. p. incandescents, all-night schedule.

Paterson, N. J., has a commercial meter rate of 10 c. per kw. hr. Street lights cost $15 and $16 a year for incandescents and $77.50 to $140, averaging $101, for 2,000 c. p. arcs, all-night schedule.

St. Joseph, Mo., has a municipal street lighting plant, in which the cost of operation is reported as $61.90 per lamp per year and the total cost $78.23, 2,000 c. p. arc lights averaging 3,177 hours a year. A private company supplies current for lighting at 10 to 5.5 c. per kw. hr., according to amount used. Commercial arc lights, 2,000 c. p., have a flat rate of $50.71 a year.

Scranton, Pa., seems to pay $73 for 1,600 c. p. arc street lights, all-night schedule.

Syracuse, N. Y., has a commercial lighting rate of 12 c. per kw. hr., with discount of 2 c. for prompt payment and a minimum charge of $1 a month. Meter rates for power are based on average load of motor, 25 kw. hr. for one horse-power minimum to be charged for, and are 10 c. per kw. hr., and 5 c. for all above the minimum, with 1 c. discount for prompt payment. Open arc, 2,000 c. p. street lights cost 18.63 c. per night, all-night schedule.

New Haven, Conn., has a commercial meter rate of 12.5 c. per kw. hr. Street lights cost $78.48 per year for 1,200 c. p. lamps, all-night schedule.

Omaha has a commercial meter rate of 15 c. per kw. hr., with 10 to 50 per cent. discount for prompt payment, according to amount used. Street lights cost $75 for 6.6 ampere lamps, and the company pays the city 3 per cent. of its gross earnings.

Tungsten Lamps for Street Lighting.

Can you give me any information concerning tungsten lamps for street lighting? Please refer me to an article in MUNICIPAL ENGINEERING.

C. W. M., Holdredge, Neb.

An article in the April number of MUNICIPAL ENGINEERING, vol. xxxvi, p. 216, compares tungsten lamps with arc lamps, much to the advantage of the former. There are some problems of durability under the severe conditions of street lighting which have not yet been worked out satisfactorily from the standpoint of economy. Progress in this line will be reported from time to time.

Prices of Paving and Sewer Work.

I would appreciate it very much if you would supply me with prices and information on the different kinds of paving and sewer work.

J. H. T., Arkansas City, Kan.

The monthly number of MUNICIPAL ENGINEERING are the best source of information concerning these matters, and general reference is made to them. Particular references upon any special kind of street or sewer work will be given upon request. As regards prices of paving work, the September number, vol. xxxvii, pp. 152, 176, contains two articles giving prices for paving, with considerable detail as to character of construction. To the list given in the latter article may be added the following from contracts let since that date:

Vitrified brick and block: Dallas, Tex., $2.52 per square yard; Kearney, N. J., $2.14; Baltimore, Md., $2.05; Milwaukee, Wis., $1.87 to $2.47.

Creosoted wooden block: Chicago, Ill., $3.15 a square yard; Atlanta, Ga., $2.49 to $2.58.

Kettle River sandstone: Milwaukee, Wis., $3.11 to $3.23.

Asphalt: Milwaukee, Wis., $2.28 to $2.45 a square yard; Baltimore, Md., $1.74.

As to cost of sewers, reference may be made to the table of cost of sewers of various sizes and materials as constructed in Clinton, Iowa, given in vol. xxxvi, p. 306; concrete sewer construction in Chicago, vol. xxxvi, p. 21; an Indianapolis concrete sewer, vol. xxxv, p. 71; sheeting sewer trenches, vol. xxiv, p. 195; a diagram of cost of excavating sewer trenches, vol. xxi, p. 407; vitrified pipe sewers of various depths, vol. xviii, p. 110; concrete sewer in South Bend., Ind., vol. xxxii, p. 190; cost of concrete sewers, vol. xxxi, p. 20, giving references to earlier articles. Many other references could be given, but these are the most detailed and the most comprehensive.

More specific answers to more specific questions will be supplied with pleasure.

Relation of Street Grades to Average Ground Surface.

Claremont is a young and small city, the home of a small but ambitious college. Streets are mostly 60 feet in width, running north and south, and east and west. Slope north to south, about 2.3 feet per hundred. From east to west, about 1 foot per hundred.

With few exceptions the irregularities of surface are so small that cuts of 1.5 foot or less in the high places, with fills of the same amount in the low places, will give a uniform grade for the length of a block. Curbs are 12 feet from property line. Grades of curbs are fixed by ordinance, with slope of one-fourth of an inch to the foot up from curb to property line. Taking each block by itself, the aim has been to fix the curb grade about six inches below the average surface; making them straight only the length of one block, and of course making them coincide at the intersections. Then in a few cases a little adjusting was done to provide drainage and to avoid too great differences of elevation between the high and low sides of streets. Some property owners on high sides of streets, and on high ground, have complained of being obliged to cut a foot or two in front of their property, as these are the places which have usually been first improved. Property owners on the low sides of streets running east and west still have to do considerable filling to bring their grounds up high enough to make a good appearance when the houses are placed back 25 or 30 feet from the property line, as is the custom here.

I would like very much to learn through your pages what has been the experience in other small cities as relates to the fixing of grades in reference to the average surface.

EDWIN SQUIRE,
City Engineer, Claremont, Cal.

Citizens of Claremont differ in opinion from property owners of the writer's acquaintance if they object to streets below the lot level. The advantages of such location of the street, if a residence street, are so great that it would seem that they need only to be seen to be recognized. It is best not to grade the lot down to the sidewalk grade except on a gentle slope along the front of the lot. This gives a sense of elevation and a point of view of the house which is much better than if the lot is at the level of the sidewalk. A business street is more convenient if the inner edge of the sidewalk and the floor of the store are practically at the same level, the floor being slightly higher and approached by a slight incline in the entrance way.

The writer lives on a street through a district below the level of high water in the stream nearby and protected from it by a levee and boulevard, but those platting and improving the district caused the street to be cut down so as to leave the lots some two feet above the street. The result is an appearance of elevation which is distinctly satisfactory, and is only nullified when the water backs up into the street from the drains when the stream is at extreme high-water stage, and when stoppage of the catch-basin inlets causes the flat street to fill with water even over the sidewalks. A block or two away the street has been cut down through the bluff adjoining the low district, so as to give a reasonably low gradient to the street, and this has left a few lots ten or twelve feet above the level of the street. The owners of these lots, aside from the difficulty of

keeping grass on the steep slopes up from the sidewalk, feel that their lots are worth a little more than those either way from them which are nearer the street level.

It is a general rule in the city engineer's office, other conditions permitting, to excavate for a street so as to place it all below the level of the front property lines, locating the street, if possible, as low as the lowest lot, provided this can be done with due attention to ease and completeness of drainage. In a city with more changes in elevation (this city being located on ground which is smooth and with very gentle slopes) greater differences in effect on lots would be found, and it would more often be necessary to cut in front of some lots and fill in front of others.

It is noticeable, where streets in the flat district above mentioned are filled up above high water, that the lot owners have a strong tendency to fill their lots up to a still higher grade, at least in front, thus giving the sense of elevation to their houses.

In laying out a system of grades for a city the first requirement is good drainage. If this must be secured largely over the surface, the grades will differ quite materially from what they would be if a system of sewers or storm water drains enables the engineer to take the water off of the street every block or two, and often deeper cuts will be necessary, and the streets will differ more from the general original level. With the storm water drains the streets can conform more closely to the general surface, and can be cut in the manner above described so as to give practically all lots at least a slight elevation above the street.

The second consideration is the elimination of steep grades. This and the raising of low districts above flood level are the only reasons generally existing for filling any part of the streets in a city. There is an occasional exception, such as a few lots where a gully is crossed, where filling of the street across the gully and of the abutting lots is the most satisfactory treatment.

With frequent inlets to sewers or drains, the grades need not be straight between corners, but can be broken so as to suit the slopes within the blocks, and can thus be used by the engineer to produce good effects other than that produced by straight lines.

The question of the treatment of streets on a side hill is an open problem, and it must be worked out for each street for itself, with due reference to the intersections with the streets running down the hill. The general rule is to set the street as low as possible without danger to the property on the upper side, both because the appearance is ordinarily better and because it is easier for the property on the upper side than for that on the lower to put itself into conformity with the street grade.

The cost of grading a street should be distributed over all the property benefited by it, and the grading directly in front of a lot should not be assessed upon that lot only. Every one on the street benefits by the grading, however much the cuts in the street may vary, and all should share in proportion to their frontage in paying the cost.

The conformity of practice in both large and small cities with the principles above stated is shown by the photographs accompanying the article on "Some Examples of Street Design" on another page in this number of MUNICIPAL ENGINEERING.

Will our readers give us some reports from their own experience concerning this interesting and important problem?

Payment for Pavement of Rail Area—Front Foot Rule in Assessments for Paving.

We have just completed paving about two miles of streets, which are occupied in the center by an electric surface railroad company. Under the railroad laws of this State the railroad company must start paving at the same time and in the same manner as the village, or under certain conditions the village may do the work at the expense of the railroad company. In seeking an adjustment with the railroad company, the question arises, whether or not the entire surface comprehended between the rails of the company and two feet on the outside thereof should be paid for by the company or whether the actual surface of the two rails should be deducted from the surface area which is to be paid for by the company. As the rails are about 2½ inches wide at the top, it makes a strip several thousand feet long and 5 inches wide. If both rails are deducted it figures a good many square yards, and makes a difference of several hundred dollars. The specifications under which the contract for the paving was let were silent on this point. The contractor, however, has been paid by the village for the entire surface of the roadway, no deductions being made for surface of the roadway not paved with brick, such as manholes and things of that nature. The railroad company elected to have the village do the work at their expense, and now when the village is seeking to reimburse itself, this question arises.

I desire to know what the practice is in other places—in New York and in the United States—concerning a situation of this kind. It is a case where I assume custom will govern, and I would like to know what the custom is. Should the surface of the rails be taken out?

I have one further question. So far as you are advised, has a "front-foot rule" of assessment upon abutting property owners of a certain proportion of the total expense of paving a street, ever been declared an inequitable method of assessment, and what objections, if any, are there to this method of assessment? The street here is practically straight and of a uniform width. There is one turn in it, almost a right angle, and almost every piece of property is improved and built up, so that everyone is benefited alike.

I have satisfied myself in reference to this method, but your sources of information as to its practical working and as to its legality, or at least what has been done with it in other places, are so much

greater than mine that I shall be glad to avail myself of such information as you might see fit to give me.

W. S. B., N. Y.

With respect to the first question, it may be said that, in the absence of any provision in the contract, it is not the custom to deduct the width of the rails in computing the area of paving in a street containing street railway tracks, or in paving around water or gas boxes or manhole covers. The difficulties in working around the rails and ties, and other obstructions, and the extra cost of special shapes of brick or of fitting bricks to rails and rims, are usually considered equal if not greater than the work of laying the smooth pavement. It may be that there are cities where there is a local custom of deducting the area of the rails from the street area, in computing the amount of paving to be paid for, but in such cases the contractor has knowledge beforehand of the custom and can make his bid to correspond. Unless there is such a local custom, or a provision in the contract, he will most probably make his bid on the basis of payment for the street as a whole, without any deduction for the iron-clad areas.

For many years States in the Central West assessed the benefits for street paving upon the abutting property in proportion to the frontage, and there was no protest. Ultimately, however, there was a decision in a special case which seemed to throw doubt upon the constitutionality of this procedure, and the laws in most, if not all, of these States were changed. The most satisfactory law, because it follows a custom based on good, common sense, is one which permits the primary assessment to be made on the basis of frontage, but provides for a hearing at which the assessments can be modified if the frontage rule is found, for any reason, to be inequitable. The actual procedure seldom changes the assessments, because lots are commonly near enough rectangular and near enough the same depth to make this manner of assessment proportionate to area, and to value of lot, if the street improved is through a district fairly uniform in values. The benefit is usually considered to be proportional to the width of the front of the lot, depth having but little effect and difference in valuation but little effect in modifying the proportion. Lots of irregular shapes may occasionally require adjustment of the assessments.

The cost of paving side streets running lengthwise of lots is very heavy in proportion to the number of lots, and the laws of many States require or permit the assessments on these streets to be distributed over lots not abutting, but with rapidly diminishing rates, with increase in distance from the street that has been paved.

There were numerous decision on this question in the courts, particularly of Pennsylvania, Ohio, Indiana, Illinoise and neighboring States, some six to twelve years ago, the resulting principles becoming ultimately those stated above. In the following references to back volumes of Municipal Engineering will be found reports of some of these decisions: Vols. xxvi, pp. 37, 105, 327, 421; xxv, 96, 180; xxiii, 458; xxii, 98; xxi, 170, 423; xix, 45, 47, 232, 424; xviii, 49,55, 124, 185, 197, 259, 315, 399; xvii, 32, 97, 171, 226, 308; xvi, 400; x, 53; ix, 173.

List of Water Works Plants.

I am desirous of getting a list of municipal and private water works plants in the various States, and ask if you can give me any information in regard to this point.

H., ——.

The latest list of water works plants is that in "Domestic Engineering Directory" ($5), which is very nearly complete and accurate, though not quite perfect.

Ordinances Concerning Sidewalks.

The city council of this city desires to pass an ordinance fixing the standard of sidewalks for the city so that only cement sidewalks can be built, and I would like to know if you can furnish me with any copies of ordinances along this line.

K. J. URQUHART, City Attorney,
Medford, Wis.

In MUNICIPAL ENGINEERING, vol. xxxvi, p. 30, will be found forms of sidewalk ordinances and resolutions and suggested provisions for such documents from which may be selected such as fit the case. Either form given can be restricted to cement sidewalks by making cement the material of which all walks shall be built. Neither of the forms given was taken from Wisconsin, and it may be necessary to modify the form or the provisions to conform to the laws of that State, but the general principle is the same. Sources of specifications are referred to in the same article.

The skeleton of ordinance given on p. 31 of the article above referred to, beginning in the second column, covers both the order to property owners to construct the walks and the construction by the city in case the property owner fails to do it within the time fixed. Sections 8 and 9, covering the order to the property owner to construct the walks, are given in full. In case cement walks only are to be permitted, specifications for only one class will be required, and sections 1, 4, 5 and 6 will be omitted, and if the construction by the city is not to be covered in the same ordinance, sections 10 to 17 can be omitted.

Good specifications for cement walks to be put in section 2 can be found in the "Hand Book for Cement Users" ($3), in back numbers of MUNICIPAL ENGINEERING, in the advertising literature of companies manufacturing good Portland cement, and

in the specifications prepared by city engineers in Wisconsin, as well as other States, for work to be done under their supervision, if such specifications are not already in use in Medford.

Ground for Appointment of Receiver for Water Company.

I am seeking through a court of equity to forfeit the franchise of the water works company on ground of bad management, and popular clamor demands an attempt to put the plant in the hands of a receiver pending the litigation, but I am extremely doubtful about it being a case for a receiver, and the more I investigate the law on that subject the more my doubts grow. If you have anything within reach bearing upon the question of the appointment of receivers in such cases I would be glad if you would send it to me. SUBSCRIBER.

The following citations may be made to cases having some bearing upon the subject, but it must be confessed that they do not give much aid to an applicant for a receiver in the case named:

In New Hampshire a court of equity will appoint a receiver whenever it shall be made to appear that the property in regard to which the controversy exists is in danger. (Alderson on Receivers, p. 112, citing Ladd vs. Hervey, 21 N. H. 514.)

Plaintiff must be clearly entitled to an interest in the property for which a receiver is asked. (Alderson, p. 74.)

Plaintiff can not demand the appointment of receiver of property in which he has no interest. (Alderson, p. 99, citing Smith vs. Wells, 20 How, Pr. 158.)

The appointment of a receiver can be made only on the application of one having an acknowledged or strong presumptive title in himself, or in common with others, in the fund, and where there is danger of loss or injury to the property, or the rents and profits. (Alderson, p. 146, citing Chase's Case, 1 Bland Cr. 206.)

There must be danger of loss (of money) before the court will take charge of it. (O'Mahoney vs. Belmont, 62 N. Y. 133, cited in Alderson, p. 113.)

In the absence of statutory provisions a court of equity will not usually assume jurisdiction to take the property of a corporation out of the hands of its officers and to intrust it to a receiver. If the officers or trustees of a corporation misconduct themselves, they may be enjoined from doing the acts complained of, or they may be removed. (Am. and Eng. Ency. of Law, Vol. 20, p. 270, citing Waterbury vs. Merchants' Union Express Co., 50 Barb. (N. Y.) 157.)

A consumer of water is not the person to bring suit for receiver for company. (Weatherby vs. Capital Cy. Water Co., 115 Ala. 156, 22 So. Rep. 140.)

The appointment of a receiver can be made only on the application of one having an acknowledged or strong presumptive title in himself, or in common with others, in the fund, and where there is danger of loss or injury to the property, or the rents and profits. (Alderson on Receivers, p. 146, citing Chase's Case, 1 Bland Ch. 206.)

While a receiver may be appointed by the court upon its own motion, in a case requiring it, a proceeding for such an appointment can not be inaugurated or conducted by a stranger having no connection with or interest in the subject-matter of the litigation. (Alderson on Receivers, p. 145, citing O'Mahoney vs. Belmont, 62 N. Y. 133.)

The propriety of appointing a receiver can not be collaterally questioned except upon want of jurisdiction. (Current Law, Vol. 10, No. 6, p. 1567, citing Title Ins. and Trust Co. vs. Grider (Cal.), 94 P. 601.)

The legality of the appointment of a receiver by the comptroller of the currency can not be attacked either collaterally or directly by a debtor of the bank. (Lyons vs. N. Y. Bank of Discount, 154 F. 391. See Current Law, Vol. 10, No. 6, p. 1468.)

What Is an Aquaphone?

I notice in your October issue some one asks the question about detecting leaks in water mains. You suggest the use of an aquaphone. What is an aquaphone, and how is it used in connection with a water main in a street, so as to detect a leak that does not come through to the surface? What is the probable cost of one?

J. J. H., Goldfield, Colo.

Water escaping from a leak in an appreciable quantity or flowing through the cock on a service pipe makes a noise and produces a vibration. It is possible to find leaks in services by using a long key with the upper end flattened so that the ear can be held against it. By turning the water off and then slowly turning it on again with the ear applied, very slight flow can be detected, as small as 5 gallons an hour being reported. If a diaphragm similar to a telephone receiver or a physician's stethoscope to magnify the vibrations is set on the end of the key rod or any iron or wooden staff, and the end applied to the pavement in the vicinity of a leak in a water main, the sound of the leak can be heard. It can be followed up with considerable accuracy by noting the variation in loudness of sound as the rod is moved. After a little practice the differences in the sounds heard can be distinguished readily. This apparatus is called an aquaphone, or waterphone. The only one on the market, so far as the writer knows, is Rodda's Water Waste Detector, made in England, with vulcanite top and bamboo stick, for 1 pound 5 shillings, or with vulcanite top and vulcanite stick for 1 pound 12 shillings, 6 pence. This piece of apparatus can probably be secured of instrument dealers, or can be made by them. An ingenious mechanic should be able to attach a telephone receiver or a stethoscope to a rod at small expense.

Can any of our readers give further information from their experience with this or other methods of locating leaks? An excellent description of a method of locating leaks by means of meters and direct

inspection, as practiced by Benjamin L. Williams, Jr., will be found in MUNICIPAL ENGINEERING, vol. xxxvi, p. 319.

Valuable Data Regarding Water Supplies.

The data under the above heading in the October number are continued herewith, with respect to a number of other cities with populations between 25,000 and 50,000.

Bangor, Me., is supplied from a river. The daily consumption is 3,609,254 gallons, which is supplied by pumps of 7,500,000 gallons capacity to filters and 3 pumps of 13,000,000 gallons capacity to the distribution system. The pump well has a capacity of 200,000 gallons and a steel standpipe has 1,590,400 gallons capacity. There are 24 mechanical filters of 4,500,000 gallons total capacity per day. The supply mains from pump to distribution are 2 of 16 and 20 inches diameter. The city has 2 steam fire engines in service. The water works pumps are 8 and 22 years old. The city owns the plant.

Lewiston, Me., is supplied from a lake. The daily consumption is 4,900,348 gallons, which is supplied by 3 pumps of 11,000,000 gallons total capacity. A reservoir with brick core wall, earth embankment and cobble stone lining has 12,000,000 gallons capacity. The main from the lake to the pumping station is 24 inches in diameter, and 2 mains to the distributing system are 20 and 24 inches diameter, and main from reservoir is 24 inches. The city has two steam fire engines in service. The water works pumps are 14 and 31 years old. The city owns the plant.

Chelsea, Mass., obtains its supply by gravity from the Metropolitan Water and Sewerage Board, and has a hgh service pumping plant in reserve. The daily consumption is 4,091,200 gallons. A distributing reservoir has a capacity of 1,000,000 gallons. The low-service supply main is 42 inches diameter, and that of the high-service 16 inches. The city has 3 steam fire engines in service and one unserviceable engine in reserve. The city owns the distribution plant.

Everett, Mass., obtains its supply by gravity from the Metropolitan Water and Sewerage Board, and uses 2,592,400 gallons a day. The low service is supplied from a Metropolitan 48-inch main and the high service from a Metropolitan 24-inch main. The city has one steam fire engine in service and one in reserve. The distribution system is owned by the city.

Fitchburg, Mass., obtains its supply from seven storage reservoirs on streams. The daily consumption of 2,900,000 gallons is supplied by gravity. The dams are riprapped earth embankments and impound 1,456,000,000 gallons. There are also two reservoirs with earth embankments, riprapped, of 61,435,000 gallons capacity. There are 4 16-inch and 1 12- inch supply pipes from various supply and equalizing reservoirs which serve the distribution system. The city has no fire engines and owns the water plant.

Gloucester, Mass., obtains its supply from streams, the daily consumption being 1,246,149 gallons, which is supplied by 2 pumps with 7,000,000 gallons capacity. Three impounding reservoirs on the streams have a storage capacity of 724,962,450 gallons, which can be increased 198,500,000 gallons by the use of flash boards. A stone masonry distributing reservoir in a natural depression has 3,000,000 gallons capacity. One supply pipe from the pumps is 20 inches diameter and one running by way of the reservoir is 16 inches diameter. The city has 6 steam fire engines in service. The water works pumps are 11 and 25 years old. The city owns the plant.

Haverhill, Mass., obtains its supply from 6 ponds, lakes and reservoirs. The daily consumption of 4,651,779 gallons is supplied in part by gravity and in part by 4 pumps of 22,000,000 gallons capacity, which pump to the lakes or in one station also to the high service. The 6 ponds have 1,777,400,000 gallons capacity and 2 distributing reservoirs have 10,000,000 gallons capacity. They have earth embankments, one with concrete core wall and the other with masonry lining. The various reservoirs have supply pipes to distribution 12, 16, 2 of 10, and 2 of 20 inches diameter. The city has 5 steam fire engines in service. The water works pumps are from 3 to 14 years old . The city owns the plant.

Malden, Mass., obtains its supply of 2,019,500 gallons a day from the Metropolitan Water and Sewerage Board 48-inch main for low service and a 30-inch branch from its high service. The city has one fire engine in service and one in reserve, and owns the water distribution service.

North Adams, Mass., obtains its supply from streams by pumping into four reservoirs. The supply main is 24 inches in diameter. The city has no steam fire engines and owns the water supply.

Quincy, Mass., obtains its supply of 3,050,000 gallons a day from the Metropolitan Water and Sewerage Board high-service pumping plant and reservoir of 5,100,000 gallons capacity with 330,000 gallon standpipe. The Metropolitan supply main is of 24 inches diameter. The city has one steam fire engine in service and one in reserve, and owns the water distribution system.

Salem, Mass., obtains its supply from a lake and a river. The daily consumption of 2,987,000 gallons is supplied by 2 pumps each of 5,000,000 gallons daily capacity. The lake and dam have 1,055,000,000 gallons storage capacity, and there is a distributing reservoir of 20,000,000 gallons capacity with earth embankments and masonry lining. The supply main from pumping station to center of distribution system is 30 inches diameter, and one from

the distributing reservoir to the same point is 20 inches in diameter. The city has 4 steam fire engines in service. The water works pumps are 36 and 42 years old. The city owns the plant.

Taunton, Mass., obtains its supply from ponds. The daily consumption of 1,903,935 gallons is supplied by 3 pumps with 15,000,000 gallons total capacity. There is also one 5,000,000-gallon pump lifting water from one pond to that supplying the main pumping station. There is also a reserve connection with the river near the pumping station with a filter basin of 1,500,000 gallons capacity for use in case of necessity. There are 2 20-inch supply mains from pumping station to center of distribution system. The city has 3 steam fire engines in service. The water works pumps are from 8 to 34 years old. The city owns the plant.

Waltham, Mass., obtains its supply from wells, the daily pumpage being 1,929,726 gallons. A reinforced concrete reservoir holds 2,000,000 gallons. The supply main is 24 inches in diameter. The city has two steam fire engines. The water works pumps are 36 years old. The city owns the plant.

Battle Creek, Mich., obtains its supply from a lake and a stream. The average daily consumption of 1,226,000 gallons is supplied by two pumps of 5,000,000 gallons capacity. The standpipe has a capacity of 143,000 gallons. The supply main is 16 inches in diameter. The pumps are 22 years old. The city owns the plant.

Lincoln, Neb., obtains its supply from 3 dug wells, with 3 pumping plants. The daily consumption is 2,192,000 gallons and the total capacity of the 7 pumps is 13,400,000 gallons. The wells are 50 to 77 feet deep and 20 to 40 feet diameter. There are also driven wells in bottoms of and near the large wells. A storage reservoir partly in excavation has concrete walls with earth embankment outside, capacity 1,313,000 gallons. The supply mains from the pumping stations are 20, 16 and 10 inches diameter, each pumping directly into the distribution mains at the nearest point. The city has one steam fire engine in service and one in reserve. The water works pumps are from 2 to 25 years old. The city owns the plant.

South Omaha, Neb., is supplied with 4,977,000 gallons a day from the Omaha water works through a 30-inch supply main. The city has no fire engines. The water works are owned by the Omaha Water Company.

Atlantic City, N. J., obtains its supply from 20 artesian wells. The daily average consumption of 5,874,000 gallons is supplied by 7 pumps of 18,000,000 gallons daily capacity. There are two standpipes. The supply mains are 12, 20 and 30 inches in diameter. The city has 11 steam fire engines. The oldest water works pump has been in use 27 years. The city owns the plant.

Auburn, N. Y., obtains its supply from a lake. The daily consumption approaches 6,000,000 gallons, and is supplied by 4 pumps of total capacity of 40,000,000 gallons a day. The supply pipes to the distribution system from the lower pumping station are 2 12-inch and 1 18-inch main, that station being served by a 24-inch supply from the upper pumping station. The city has one steam fire engine in service. The water works are owned by the city.

Binghamton, N. Y., has a river supply of 6,313,000 gallons a day, with 2 10,000,000-gallon pumps lifting water to the filters and 3 12,000,000-gallon pumps sending water into the distribution system. The clear-water basin at the filters is the only reservoir, aside from the dam in the river and the sedimentation basins of the 12 mechanical filters, which latter have a capacity of 10,000,000 gallons a day. The supply mains running from the station in various directions to the distribution are 24, 20 and two 12-inch diameters. The city has one steam fire engine in service and 2 in reserve. The water works pumps are from 7 to 19 years old. The city owns the plant.

Newburgh, N. Y., obtains its supply from a lake and a stream. The daily consumption of about 5,000,000 gallons is supplied by gravity with 3 pumps, combined capacity 3,400,000 gallons on high service. The supply main is 24 inches, connecting to 20-inch main to distribution system. The city has 4 steam fire engines in service. The city owns the water works.

Charlotte, N. C., is supplied from creeks, the daily consumption of 1,324,567 gallons being taken care of by 2 pumps to the filter plant with 7,000,000 gallons capacity and 7 pumps in 3 stations with total capacity when all are in condition of 17,500,000 gallons a day. Three dams have 91,000,000 gallons storage capacity, the clear-water well 400,000, and a steel standpipe has 710,000 gallons in the distribution system. The filters are of the mechanical type, the 10 units giving 5,000,000 gallons a day capacity. Two 20-inch mains from the main pumping station serve the distribution system, and one 12-inch from a smaller station can be used. The city has one steam fire engine in service and one available in reserve. The water works pumps are 3 to 27 years old, and the plant is owned by the city.

Wilmington, N. C., is served from a river, the 1,022,000 gallons daily consumption being supplied by 2 pumps lifting the water to filters, with 3,000,000 gallons capacity, and 4 sending it to the distribution system, with 6,250,000 gallons capacity. The storage available is the clear-water well with 75,000 gallons capacity and a standpipe with 211,000 gallons. There are a coagulating basin and four 500,000-gallon mechanical filter units in the filter plant. A 12-inch main, which is considered wholly inadequate, extends from the pumping station through the

length of the distribution system. The city has 2 steam fire engines in service, one mounted on a boat, and one in reserve. The water works pumps are from 3 to 27 years old. The city owns the plant.

McKeesport, Pa., takes its supply from wells. The latest report at hand states that the daily pumpage is 4,031,281 gallons, and that there are 5 pumps with a combined capacity of over 11,000,000 gallons. There is a mechanical filter. The supply main is 20 inches in diameter. The city owns the plant.

Columbia, S. C., obtains its supply from a river. The daily consumption is 2,369,720 gallons. Two pumps of 24,000,000 gallons daily capacity lift the water to the 50,000,000 gallon sedimentation basin, and 4 pumps in two stations of 17,000,000 gallons total capacity send it to the distribution system. The storage is 2,750,000 gallons in an open concrete clear-water basin, a 531,000-gallon standpipe, and a brick, cement-lined reserve gravity reservoir of 1,500,000 gallons capacity. The filter plant includes a coagulating basin of 480,000 gallons capacity and 6 concrete gravity mechanical filters each of 1,125,000 gallons capacity a day. The supply mains to the distribution system are a 24-inch from the new pumping station and 2 12-inch from the old, one being in reserve. The city has 3 steam fire engines in service and one in reserve. The water works pumps are 3 years old. The city owns the plant.

Houston, Texas, derives its supply from artesian wells. The average daily consumption of about 11,000,000 gallons is supplied by two pumps having a total daily capacity of 19,000,000 gallons. The city purchased the plant in 1906.

Norfolk, Va., obtains its supply from creeks, lakes and artesian wells. The average daily consumption of 6,952,756 gallons is supplied by 6 pumps with total capacity of 32,000,000 gallons a day. There are six lakes serving for storage, made by dams of earth. There is a coagulating basin and a mechanical filter plant. The supply mains are 30, two 24 and 16 inches diameter. The pump which runs most constantly is 18 years old. The city owns the plant.

Petersburg, Va., obtains its supply from a creek in two storage reservoirs. The daily consumption of 454,080 gallons is supplied by two pumps of 4,500,000 gallons total daily capacity. The two earth dams give 103,000,000 gallons storage, the clear-water well 60,000 gallons, and the two distributing reservoirs 5,700,000 gallons. The latter are of earth embankment, bottom and sides being lined with brick. The filter plant includes a coagulating basin of 1,000,000 gallons capacity and 3 gravity mechanical filters each of 500,000 gallons capacity. The supply main from the pumping station to the distribution system is 16 inches diameter. It is continued to the new distributing reservoir with the same size. The city has 2 steam fire engines in service and 2 old engines in reserve. The water works pumping engines are 8 and 14 years old. The city owns the plant.

Roanoke, Va., obtains its main supply from a spring. The daily consumption of 4,076,830 gallons is supplied by 3 pumps with total daily capacity of 9,000,000 gallons. The spring water is collected in a concrete storage basin and is pumped to a reservoir in excavation and embankment, with bottom and sides lined with puddled clay and brick laid in cement, having 2,000,000 gallons capacity. The two supply mains from the pumps to the distribution system are 16 and 12 inches in diameter. The city has one steam fire engine in service and one in reserve. The water works pumps are from 3 to 22 years old. The plant described is owned by the Roanoke Gas and Water Company. The Vinton-Roanoke Water Company supplies water for manufacturing purposes and a little for domestic service. It has a 10-inch main from reservoir.

Wheeling, W. Va., is supplied from the river. Its daily consumption is 17,469,000 gallons, or 400 gallons per capita. It is furnished by 3 pumps with 27,000,000 gallons capacity. The distributing reservoir has stone masonry side walls, concrete and asphalt bottom, is in two sections and of about 3,000,000 gallons capacity. There are two 30-inch force mains from the pumps, two miles to the reservoir, and there are one 18 and three 20-inch connections of reservoir with distribution system, also an emergency connection between 20 and 30-inch mains. The city has 4 steam fire engines in service. The water works pumps are 11 and 17 years old. The city owns the plant.

Madison, Wis., obtains its supply from 9 artesian wells. The average daily consumption of 1,564,085 gallons is supplied by 2 pumps having 5,500,000 gallons daily capacity, with a concrete reservoir of 1,000,000 gallons capacity and 16-inch supply mains. The oldest pump is 27 years old. The city owns the plant.

Superior, Wis., obtains its supply from 86 driven wells of 6 and 8-inch diameter and about 40 feet deep. The daily consumption of 2,226,700 gallons is taken care of by one 5,000,000-gallon pump pumping to filters and 4 pumps of 11,500,000 gallons total daily capacity pumping to distribution. The filter plant includes an aerator, three slow sand filter beds and a clear-water reservoir of 350,000 gallons capacity. The supply mains from the pumping station are one 16-inch and one 12-inch diameter. The city has 3 steam fire engines in service. The pumps in the water works are from 1 to 17 years old. The plant is owned by the Superior Water, Light and Power Company.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Asphalt Pavement Thickness and Guaranty Period.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Since my report on "Pavement Guaranties," December 11, 1907, with reasons for shortening the period of guaranty, most bonding companies have ceased to issue guaranties for more than five years. Cities have generally reduced the period to five years or less. As stated in that report (to be had from MUNICIPAL ENGINEERING or from the author), "A guaranty bond takes a pavement from the control of the engineering department and puts it in the legal department of a city, which is an unsatisfactory way to convert a poor pavement into a good one. Two years are sufficient to demonstrate the quality of a pavement laid under inspection of a competent man in any city. Taxpayers wish a good pavement on a street, and not a bond in a city hall."

Efforts are being made by some persons to reduce the thickness of the asphalt pavement wearing surface, the binder, now that the bonded guaranty is shortened. Other municipal improvements than pavements are not made thinner and of less value when constructed under engineering inspection without guaranty. Pavements should be laid of full thickness and good quality under municipal engineering inspection, whether guaranteed or not. A past monopoly and desire to introduce asphalt pavements at a time when knowledge of them was not common to engineers was the cause of agents for such pavements offering guaranties.

The following extracts from opinions of city officials show that two inches of wearing surface and one and one-half inches of binder are little enough, with or without guaranty.

Baltimore: "I would greatly prefer increased thickness of topping in an asphalt pavement rather than increased length of guaranty, and my specifications provide for two inches of wearing surface, with a five-year guaranty. My experience with guaranties is that they are worthless. The outcome of a suit is most uncertain."

Buffalo: "The thickness of our asphalt wearing surface is two inches and binder one and one-half inches. For large towns two inches is not too thick in much-traveled streets. My opinion is that we should not reduce the thickness of the wearing surface."

Chicago: "Better to specify surface two inches thick, with a five-year guaranty, than one and one-half inches thick with a ten-year guaranty. An extra half inch surface is of greater benefit than an extra five-year guaranty."

Cleveland: "We make the wearing coat two inches thick. The term of the guaranty should be shortened, and the engineer should assume more responsibility."

Columbus: "I would consider a two-inch surface laid under competent inspection with a five-year guaranty of greater benefit than a one and one-half inch surface with a ten-year guaranty."

Duluth: "It is better to specify an asphalt pavement surface two inches thick, with a five-year guaranty, than a one and one-half inch surface and a ten-year guaranty."

Harrisburg: "We use a one-inch binder and two inches surface, and guaranty five years. In Pennsylvania you could scarcely make the guaranty more than five years without invalidating the assessments."

Kansas City, Mo.: "Engineers in charge of paving in our cities were relying too much on tradition and precedent, and are not giving the subject the real engineering attention which it deserves. It seems to me that if the engineers would use discretion in the selection of materials, proportions used, thickness of the binder coat and of the wearing coat, that much better results would be obtained for the taxpayers and also the asphalt companies."

Lima: "We require a two-inch wearing surface and guaranty for five years. It is better to lay a two-inch surface with a five-year guaranty than one and one-half with a ten-year guaranty."

Milwaukee: "We use two-inch surface and five-year guaranty. It is better to specify a wearing suface two inches thick with a five-year guaranty than one and one-half with a ten-year guaranty. An extra half-inch wearing surface is of greater benefit to a city than an extra five-year guaranty."

New York City: "In my judgment it is

better to specify asphalt pavement wearing surface two inches thick with a five-year guaranty than one and one-half inches with a ten-year guaranty. I believe it is better to have the extra half inch wearing surface than an extra five-year guaranty."

Paducah: "I do not believe a wearing coat one and one-half inches thick, under heavy traffic, would last ten years, and hence the contractor required to make this bond would necessarily have to increase his bid. I therefore never require more than a five-year guaranty, but have the work closely inspected during construction, so as to insure the very best construction possible."

Pittsburg: "The thickness of asphalt (on top of binder) as required by the specifications is two inches, guaranty five years. A one and one-half inch layer of asphalt and a ten-year guaranty period would be decidedly unsatisfactory."

Racine: "I think it is better to specify a good pavement and see that it is properly laid, and not depend too much on the guaranty. We have a two-inch wearing surface and five-year guaranty."

Shreveport: "I prefer no maintenance bond on asphalt paving beyond a limited time, long enough to allow the engineer to examine the wearing surface thoroughly and have same corrected before final acceptance. Every city could get cheaper and better work done by all asphalt companies if they did not have to maintain same. We could get thicker wearing surface and better grade of asphalt, and cheaper prices, and above all take it out of the lawyers' hands."

Toledo: "We lay a binder course one inch thick and wearing course two inches, with a five-year guaranty. It is far more satisfactory to lay a wearing course two inches thick with five-year guaranty than one and one-half inches thick with ten-year guaranty."

Troy: "I believe that two-inch thickness with five-year guaranty would be better than a one and one-half inch thickness with a ten-year guaranty, for the reason that our experience with pavements of a one and one-half inch surface, down ten years, has worn in many places so that it is very thin and will only last a very short time after the guaranty period has expired."

J. W. HOWARD, Consulting Engineer
on Pavements, New York City.

Municipal Engineering in Portland.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I find that I was in error in two particulars in the article on "Municipal Engineering in Portland" in the September number:

1. Portland did have a Board of Public Works at one time, it being in existence for six or seven years.

2. The district plan of paying for street improvement assessments has been used to a limited extent, mostly for paying for some large street fills in past years.

It has not been used nearly so much as it should be, and the direct assessment against abutting property is a method carried further in Portland than in most cities, as I stated in the article.

W. P. HARDESTY, Portland, Ore.

Amiesite.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I notice on p. 256 of your October number an inquiry concerning Amiesite. Amiesite was invented by Mr. J. H. Amies, president of this company. The operating company is the Amies Road Company, 582 Bourse Bldg., Philadelphia, Pa. This is the first year of operation of that company, and they have laid and are laying a number of roads in Pennsylvania and New Jersey, particularly New Jersey.

AMIES ASPHALT CO.,
Philadelphia, Pa.

Wide Tires Again.

To the Editor of MUNICIPAL ENGINEERING:

Sir—Hurrah forMr. James Owen! He has put the shoe on the right foot in regard to road destruction. I am very glad to see the prevalent error corrected, and the responsibility put on the narrow tire, where it belongs now as ever.

An unfortunate error occurs in the sixth paragraph of your account. I am sure that it was not a "wide-tired wagon" if it "tended to bring about a complete breaking up of the road." No, sir! The wide tire wagons that I have used, and heard of others using, have never shown any such tendency. Far from it.

In a case reported from New York State (O. R. I. Bulletin 12) 4, 5 and 6-in. tires, so far from hurting the macadam road, actually improved it and wiped out the extra 33 1-3 per cent. cost of hauling previously due to the narrow tires replaced.

In my wheel test on a good macadam road the 6-in. tires saved the 41 per cent. greater average pull of the 1½-in. tires—made that road better by about 55 per cent., in that they made the haulable, or net, load that much greater for a given effort. They also virtually improved the road by the difference in cost between no perceptible wear and that resulting in a track of stone dust from ¼ to ⅜ in. in depth. Oh, well! that may be a little too much to claim in the absence of tests to show how much dust the 141 per cent. load on the 6-in. tires would make.

Wide tires in general use would still further improve roads to be built, by making their first cost about one-half as great as narrow tires now make it.

But, after all, the best showing is that of the Missouri Experiment Station's twice repeated, carefully made competitive trials of good wheels vs. "good roads."

Three earth roads gave:

1½-in. tire pull.....	86 lbs.
6-in. tire pull.....	61 lbs.
	25 lbs.

Three macadam roads gave:
1½-in. tire pull..... 71 lbs.
6-in. tire pull..... 55 lbs.
16 lbs.

1½-inch tires gave:
On 3 earth roads..... 86 lbs.
Or 3 macadam roads... 71 lbs.
15 lbs.

Multiplying these savings per ton-mile by the relative mileage-percentage of roads to which they apply, we have this astonishing result:

Where the road "improvement" would save 210 lbs., wheel improvement would save 225 lbs. more on the 7 per cent. of roads—say 14 per cent. of traffic—improved, and 2,150 lbs. on the 93 per cent. roads—or say 86 per cent. traffic—remaining unimproved.

In this test the 1½-in. tire pulls are substantially correct and representative as found, but the 6-in. tire pulls are too great, since the general use of wide tires was not represented.

Other tests indicate a still greater disadvantage in the narrow tires under worse weather conditions.

Can't you publish this test as a regular monthly feature? It is in no sense my test; is better than I was able to make; so you would not be advertising me, although I rather think I did discover the true character and great significance of the test.

Mr. Yoakum is sending a party from Arkansas, Louisiana, Missouri, Oklahoma and Texas to study "good roads" at Washington, D. C., and in the East. Since these five States have only 1 per cent. of their roads "good," would it not be much more to the purpose to seek to save the ,502 lbs. lost to narrow tires on the 98 per cent. of unimproved roads and 2 per cent. improved (allowing double traffic on the 1 per cent.) than to essay to increase the 30 lbs. "saved" by the 1 per cent.?

Which would benefit the people more, which would benefit the railroads more—to cut out 25 lbs. pull per ton-mile on 98 miles of road, or to recover 15 lbs. per ton-mile on 2 miles by improving the 2 miles? J. M. HEISKELL, Memphis, Tenn.

Number of Brick in Sewers.

To the Editor of MUNICIPAL ENGINEERING:

Sir—I enclose a table compiled by myself showing number of brick in sewers. There are in fact two tables, which you may publish if desired.

G. H. BROWN, C. E., Toledo, O.

TABLE SHOWING NUMBER OF BRICK IN CIRCULAR SEWERS.

Size of brick 2½ x 4" x 8½". Joints ¼", except bet. rings ⅜".

Diam.	1-ring.	2-rings.	3-rings.	One Lineal ft. of Sewer.		
				1-ring.	2-rings.	3-rings.
24 in.	27.42	64.83	112.24	37.60	88.90	153.93
30 in.	34.30	78.54	132.80	47.00	107.71	182.12
36 in.	41.13	92.25	153.37	56.40	126.51	210.34
40 in.	45.70	101.38	167.07	62.67	139.03	229.12
45 in.	51.40	112.81	184.21	70.50	154.71	252.63
48 in.	54.83	119.66	194.50	75.20	164.10	266.74
54 in.	61.69	133.37	215.05	84.60	182.90	294.92
60 in.	68.54	147.08	235.62	94.00	201.70	323.13
66 in.	75.40	160.79	256.18	103.40	220.51	351.33
72 in.	82.25	174.50	276.74	112.80	239.31	379.52
78 in.	89.10	188.21	297.30	122.19	258.11	407.72
84 in.	95.96	201.92	317.87	131.60	276.92	435.93
90 in.	102.81	215.62	338.43	140.99	295.70	464.13
96 in.	109.67	229.33	359.00	150.40	314.51	492.34

TABLE SHOWING NUMBER OF BRICK IN CIRCULAR SEWERS.

Size of brick 2½" x 4" x 8½". Joints ⅜", except bet. rings ½".

Diam.	1-ring.	2-rings.	3-rings.	One Lineal ft. of Sewer.		
				1-ring.	2-rings.	3-rings.
24 in.	26.22	62.28	108.18	35.45	84.20	146.26
30 in.	32.78	75.40	127.85	44.32	101.94	172.85
36 in.	39.34	88.51	147.52	53.19	119.66	199.45
40 in.	43.71	97.25	160.63	59.09	131.48	217.17
45 in.	49.17	108.18	177.02	66.47	146.25	239.33
48 in.	52.45	114.74	186.86	70.91	155.13	252.63
54 in.	59.00	127.85	206.52	79.77	172.85	279.21
60 in.	65.56	140.96	226.19	88.63	190.57	305.81
66 in.	72.12	154.07	245.86	97.50	208.30	332.40
72 in.	78.67	167.19	265.53	106.36	226.04	358.99
78 in.	85.23	180.30	285.20	115.23	243.76	385.59
84 in.	91.79	193.41	304.87	124.10	261.49	412.18
90 in.	98.34	206.52	324.54	132.95	279.21	438.78
96 in.	104.90	219.64	344.20	141.82	296.95	465.36

Type of Boiler Furnace for Burning Debris from Sewage.

For a considerable period the Metropolitan Water and Sewerage Commission of Massachusetts have followed the practice of compressing into blocks the material collectde with their screens before the sewage enters the pumps and utilizing it for fuel beneath their boilers. They early learned, however, that the brick work was burned out very rapidly whenever this fuel was used in connection with externally fired boilers. On the other hand, it was found to have no effect upon the steel plates. As a result internally fired boilers have been adopted.

In an installation made at Deer Island, in accordance with plans by F. W. Dean, engineer, of Boston, a number of horizontal return tubular boilers were to be replaced by those of the internally fired type. Scotch boilers were adopted, the combustion chambers being made of steel plate with water spaces and without brickwork, except in the bridge walls and around the fire doors. All objectionable effect of the gases from the sludge was thereby avoided. The compactness and convenience of this type is shown by the fact that they met the requirements where there was insufficient room for vertical boilers, and where the locomotive type could not be used because of lack of space to remove and replace the tubes. But with the Scotch type the tubes could be drawn within the firing space of the boiler house.

MUNICIPAL MATTERS IN COURT

Higher Courts—Water to Parks—Opinion on Bond Issue—Brick Streets Under County Law

Decisions of the Higher Courts of Interest to Municipalities.

BY J. W. KENNEY, ATTORNEY, INDIANAPOLIS, IND.

City Liable for Injuries to Traveler Until Street is Closed.—Although a city, in changing the surface of a street, does so under St. 1897, p. 550, c. 519, authorizing the abolition of a certain grade crossing, it will be liable for injuries to travelers along the street, where no order appears to have been made by proper authorities formally closing the street to public travel. (Hurley v. City of Boston [Mass.], 88 N. E. 586.)

City's Creation of a Drain Ending Upon Private Property—Liability.—A town placed culverts in its streets so that water discharged from private drains would be collected and carried on to the land of plaintiffs, who stopped up the end of the culvert, which was upon their land, and thereafter the mayor and some of the councilmen of the town entered upon the plaintiffs' land, and against their wishes and without legal action extended the drain still farther on plaintiffs' land. Held, That the discharge of the water and filth upon plaintiffs' land was a nuisance, and the entry of the mayor and councilment, and the extension of the drain, was a trespass, and that the town was liable in damages for the maintenance of such nuisance, as the creation and maintenance of a nuisance is not a governmental function which would render a town not liable for damages resulting therefrom. (Fitzgerald v. Town of Sharon [Iowa], 121 N. W. 523.)

Sidewalk Obstructed by Doorstep—No Liability for Injuries.—A city is not liable for injuries caused by a fall over a doorstep, where there was a safe footway of 6 feet 4 inches between the steps and the curb. (White v. City of Philadelphia [Pa.], 72 A. 856.)

Use of Skids Over Sidewalk Not an Unreasonable Obstruction.—It was agreed in an action by a merchant to restrain the city from interfering with the use of skids to convey merchandise to and from a building over the sidewalk that the use of skids obviated the necessity of placing merchandise on the sidewalk, and enabled plaintiff to remove it in from one-half to one-tenth of the time otherwise required; that there is no other method by which it could be removed with less obstruction; that unless the use of skids or other mechanical appliance be permitted it would be impossible for plaintiff to move to and from its building the bulky packages in which it deals, and it could not successfully prosecute its business; and that the skids are used only when reasonably necessary in the conduct of plaintiff's business. Held, To entitle plaintiff to an injunction restraining interference with the

reasonable use of skids. (John A. Tolman & Co. v. City of Cricago [Ill.], 88 N. E. 488.)

Use of Skids Not a Nuisance.—The use of skids in moving merchandise to and from a store building over a sidewalk is not a nuisance. (Idem.)

Ordinance Leasing Space on Streets or Sidewalks Invalid—Nuisance. — Compiled St. 1907, sec. 1176, conferring on the mayor and council of a city of the first class control of all public ways and grounds within the city, does not authorize the enactment of ordinances leasing space on streets or sidewalks in front of business houses for use by produce dealers or other merchants; such use being unlawful and constituting a nuisance per se. (Chapman v. City of Lincoln [Neb.], 121 N. W. 596.)

City Can Not Pervert Street to Private Use.—Though a city may vacate a street, it can not authorize its perversion to other or private uses so long as it remains, nor can the city grant the right to occupy permanently any part of it with any structure or device for private use, convenience or profit. (Lacey v. City of Oskaloosa [Iowa], 121 N. W. 542.)

Injuries Sustained in Unbarricaded Street—Negligence—City's Liability.—So long as streets remain unbarricaded and open to public use, there is an implied invitation for the use, and a person using them is not negligent unless he has knowledge of the dangers incident to the proper use thereof, and the mere knowledge of the general unsafe condition of such a street on the part of one using it with a right to do so would not render him negligent. (Scurlock v. City of Boone, 121 N. W. 369.)

Taking or Injury of Property Not Ground for Compensation for Termination of Use of Land Under Street.—The legislature may authorize the building of a tunnel in a street without making compensation for bringing to an end a use which the owners of the fee in the street had theretofore made of the land under the street. (Fifty Associates v. City of Boston [Mass.], 88 N. E. 427.)

Indemnity by Contractor for Public Improvement Against Liability for Injuries. —The resolution of the city council and the contractor's bond executed pursuant thereto provided that the contractor should conform to the regulations of the board of public works, and "indemnify, protect and save harmless" all persons who may be injured by default in any of the conditions of such bond. The regulations of the board of public works required the contractor to properly guard and light the walk during construction. Held, That injuries to a pedestrian from negligence of the contractor in failing to provide a proper barrier or guard and lights along a dangerous place during the construction of the walk are within the conditions of the bond. (Cox v. Fidelity & Deposit Co. of Maryland [Mich.], 121 N. W. 494.)

Ordinance to Renounce Contract — Remedy.—Defendant corporation having entered into a formal contract for street and city lighting with plaintiffs for five years, before the time arrived for performance passed a resolution that the negotiations (referring to the contract) were cancelled and annulled and held for naught. Held, that such resolution was a renunciation of the contract by the city, entitling plaintiffs to sue thereon at once, plaintiffs being entitled to the maintenance of the contractual relation, and not merely to a performance when the time for performance arrived.—Block v. City of Meridian (Miss.), 169 F., 516.

Change to Established Grade of Street. —Although the grade of a street is established by ordinance, it is also necessary that the change to the established grade should also be made under authority of an ordinance, and a resolution is not sufficient.—Powell v. City of Excelsior Springs (Mo.), 120 S. W., 106.

Extension of Time in Contract. — Where the time allowed for the completion of a contract for the improvement of a street is found to be too short by reason of excessive rainfall, floods and continued bad weather, and the contract fails to provide for an extension of time for such causes, the time for the performance of the contract may still be extended, though the city need not do so.—Montague v. W. H. Kolkmeyer & Co. (Mo.), 120 S. W., 637.

Indemnity Clause in Street Improvement Contract Renders Void.—The presence in a street improvement contract, of a stipulation that all loss or damage arising from the nature of the work to be done under the contract shall be sustained by the contractor, renders the assessment and all subsequent proceedings therein void.—True v. Fox (Cal.), 102 P., 263.

No Appeal From Report of Appraisers.—Under Act 1905, p. 292, c. 129, sec. 111 (Burns Ann. St. 1908, sec. 8716), providing for assessment of benefits for street improvements and declaring that the report of appraisers shall be final and conclusive on all parties thereto, no appeal lies from such report or appraisement.—Randolph v. City of Indianapolis (Ind.), 88 N. E., 949; Wilson v. Same, Id. 950.

Rule as to Defect in Sidewalk or Street.—A city is not liable for an injury from a defect in a sidewalk or street unless the defect was created by the city or with its knowledge, actual or constructive, and it was negligent in not repairing it within a reasonable time after it knew or should have known thereof.—City of Portsmouth v. Houseman (Va.), 65 S. E., 11.

Delinquency in Payment of Street Improvement Assessment—Contractor Entitled to Proceeds From Penalties.—Plaintiff constructed a pavement under a contract with the city, which provided that upon the completion of the work the cost should be assessed upon abutting owners and certificates of special assessment should be accepted by plaintiff in payment, payable in installments if requested, with 6 per cent. interest, and an ordinance provided that, where property owners did not pay the assessments in installments as permitted, the whole amount should be payable at the same time as the March semi-annual payment of ordinary taxes, and made the same provision as to maturing installments, where that plan was adopted. Code, sec. 1413, imposes interest as a penalty of 1 per cent. per month for the whole, if the first installment of taxes is not paid by a certain date, and sec. 825 provides that the special assessments with interest shall become delinquent on the 1st day of March next after maturity, and shall bear the same interest and penalties as ordinary taxes. Held, that since plaintiff and not the city or county, was injured by the delay in paying the special assessments for which certificates were issued to him in payment of the work, he was entitled to the penalty collected under the statute; the penalty being incident to the tax, and not being "interest" in addition to the 6 per cent. stipulated in the contract.—Barber Asphalt Paving Co. v. Webster County (Iowa), 121 N. W., 1072.

Street Carnival a Public Nuisance—City Liable for Injurious Consequences.—A city authorizing by affirmative acts the use of its streets for a carnival, with necessary shows and structures, authorizes the creation of a public nuisance and becomes a participant in creating and maintaining it, and is liable for injurious consequences to any one in a position to complain of the nuisance.—Van Cleef v. City of Cnicago (Ill.), 88 N. E., 815.

Annexation of Territory—Time for Improvement of Streets.—Where a territory is annexed to a city the city has a reasonable time in which to render the streets therein reasonably safe for travel before it can be held liable for injuries for defects therein.—City of Richmond v. Mason (Va.), 65 S. E., 8.

Blowing of Steam Whistle Near Bridge Is Negligence.—Where a city owning a waterworks system near a bridge owned by it blew a loud steam whistle near the bridge to notify employes of the time of day, and such whistle had for years frightened horses on the bridge, it failed to discharge its duty to so use its property as to do unnecessary damage to others and to use reasonable care to keep its bridge reasonably safe.—City of Winona v. Batzet (U. S. C. C. A., Minn.), 169 F., 321.

Contractor Not Liable for Subcontractor's Negligence.—A contractor, acting as the agent for an abutting property owner, obtained a permit from the city to open a street for the construcion of a vault under the sidewalk and for the construction of a bridge over the excavation, to accommodate traffic. Held, that the contractor having let the construction of the bridge to a subcontractor, he was not responsible for injuries to a pedestrian caused by the collapse of the bridge.—City of New York v. Corn (N. Y.), 117 N. Y. S., 514.

In Annexing Territory City Must Be Allowed Reasonable Time to Render Streets Safe.—In an action against a city for injuries from a defect in a street in territory which had recently been annexed to the city, on the question whether the city at the time of the injury had had a reasonable time in which to render the streets safe, so as to render it negligent in failure to do so, evidence was admissible showing the extent of the streets in the annexed territory, their wretched condition when annexed, lack of facilities for lighting, and the practical impossibility, for various reasons, of repairing and lighting the streets between the time of annexation and the time of accident.—City of Richmond v. Mason (Va.), 65 S. E., 8.

When Municipal Corporation Is Liable for Defect in Street.—A municipal corporation is liable for injuries from a defect in a street only where it has been negligent in caring for the street; what constitutes negligence in a particular case being a mixed question of law and fact.—Id.

Limitation of City Debt Applied to Time of Issuance of Bonds.—It is sufficient under Const., sec. 158, limiting the indebtedness of fourth class cities to 5 per cent. of the assessed value of the property, that the indebtedness does not exceed the constitutional limitation at the time of issuance and sale of the bonds, and the fact that the existing indebtedness, together with that created by the bonds, exceeded the limitation at the time of the election to authorize the issuance of the bonds, would not make them invalid; the indebtedness not being created until the bonds were sold.—Frost v. Central City (Ky.), 120 S. W., 367.

Interest Reserve—Not Taken Into Account in Determining Limit of Indebtedness.—In determining whether an indebtedness will be created by a proposed issue of municipal bonds in excess of the limit authorized by Rev. Codes, sec. 3259, subd. 64, the interest received is not to be taken into account and added to the principal.—Carlson v. City of Helena (Mont.), 102 P., 39.

Olean Must Supply Water to Its Park Department.

Justice Brown handed down a decision in special term of supreme court at Buffalo, N. Y., recently, ordering the water department of the city of Olean to supply water to the park department of that city. The water department had opposed the application of the park commissioners to supply water for public purposes in the park, claiming that the park department owed and refused to pay a bill rendered by the water department.

In his decision in regard to the contention of the water commissioners that it would be unfair to compel the ordinary water consumers to pay a fixed rate and allow the city to pay its water bills by taxation, Justice Brown held that such a contention cannot be maintained.

Proposed Waterloo Bond Issue May Be Illegal.

According to the opinion of Harry Weber, a bond expert of Chicago, the city of Waterloo, Iowa, has exceeded its constitutional debt limit by the issuance of $525,000 water bonds, and the election authorizing the issue of bonds is illegal. The debt limit of Waterloo is $480,861.06. Mr. Weber briefly summarizes his opinion as follows:

1. The voters of the city have not sanctioned either the purchase of the existing plant or approved a contract providing for the purchase and the issuance of bonds therefor.
2. The submission of a proposition to issue $525,000 of bonds for the purchase of the existing plant and making extensions thereto was improper:
   (a) It was dual in its nature.
   (b) It provided for an indebtedness in excess of the constitutional limit.

Brick Streets to Be Built in Danville, Ind., Under Three-Mile Road Law.

An attempt was made recently to enjoin the board of county commissioners from letting contracts for the improvement of certain streets in Danville, Ind., under the provisions of the three-mile road law. In an opinion handed down October 2, however, Judge E. Webb Felt, of Greenfield, sitting as special judge in the suit, refused the injunction and dissolved the restraining order, saying that the plaintiffs had no case in court; that their remedy, in the first place, would have been an appeal from the action of the commissioners in granting the petitions for the improvements. Judge Felt held that an appeal to a higher court was impossible by law.

Contracts will soon be let for improving six miles of streets, as a result of the decision.

MUNICIPAL AND TECHNICAL LITERATURE

Asphalt Repairs—Washington Disbursements—Municipal Reports—Architects' Directory—New Publications

Accuracy in Washington Disbursements.

In his annual report, submitted to the commissioners of the District of Columbia October 6, Louis C. Wilson, disbursing officer of the District, stated that in the disbursement of $10,265,768.75 during the fiscal year ended June 30 not one cent of the government money was lost. The approximate number of payments to employes by check during the year, including teachers and other employes of the public schools, policemen, firemen, and employes of charitable institutions, was 46,800, and the approximate number of payments to District employes in cash was 62,400. Among all these payments not a cent was lost, either through error in calculation or identity of the payee. Mr. Wilson says:

The various methods looking toward the careful and accurate disbursement of the District's funds, which were set forth in detail in my report for the year 1908, such as daily balance, a monthly abstract, statement of subsidiary cash accounts, cash books, etc., are continued in vogue, and every effort is made to perfect the minor details of official business in this office to maintain its record for efficiency.

Cost of Municipal Asphalt Repairs at St. Joseph, Mo.

A report was filed with the board of public works at St. Joseph, Mo., October 8, by Henry L. Meyer, superintendent of the asphalt repair plant. The street gang has been enabled to lay asphalt cheaper, with the plant, than has ever before been accomplished in the city's history, even when the street railway company was making its most favorable prices for the city's work. Before the plant was purchased

asphalt repairing cost $1.40, but with the plant the same work was done as low as 86 cents a square yard, and further reduction is promised when the plant is installed at the work-house, so that the prisoners can be used for some of the work.

Architects' Directory.

The ninth edition of the "Architects' Directory and Specification Index," for 1909, has just been issued by William T. Comstock, 23 Warren street, New York. It contains a complete list of the architects of the United States, Canada, Cuba and Porto Rico, classified by states and towns; also of the landscape and naval architects of the United States and Canada. There are lists of the architectural societies and organizations of the world, with the names of their principal officers, of architects of boards of education and of the officers of the building departments in the principal cities of the United States and Canada. There are also lists of periodicals devoted to the interests of architecture and building, and of books upon these subjects. The specification index gives the names of prominent dealers in and manufacturers of building materials and appliances. The book, cloth bound, 212 pages, will be sent for $3 net. The book is a valuable reference book for architects and their correspondents.

Municipal Reports.

Report of the Chief Engineer of the Board of Estimate and Apportionment of the City of New York for 1908. Nelson P. Lewis, Chief Engineer.

The rapid increase in the importance of the office for which this is the annual report is shown in figures by the increase in size of the report from 84 pages in the first report, covering the first two years of the existence of the board under its present form, 1902 and 1903, to 411 pages in this, the fifth report, which is for the one year, 1908, and is dated May 10, 1909.

It is shown also in the character of the work reported upon and the character of the reports. Thus the first report was made by the chief engineer alone, and was practically a routine report of work authorized for the various boroughs of the city and under construction by them. Whereas the present report, in addition to this enumeration, shows the efforts that are made by the department to co-operate with and supplement the work of the various bureaus and departments in the various boroughs, and presents the principles upon which these efforts are based. The chief engineer's report sets forth these things in the 44 pages devoted to it. The report of the engineer in charge of the division of public improvements, Arthur S. Tuttle, covers 267 pages, and, besides the statistical matter, gives a continuous history of the progress during the year. Under the heading "City Map" are gathered the descriptions of changes made in the documents bearing that title on account of new streets, vacations, changes of railroad, dock and street lines, parks and public improvements. The theory on which the general ordinances, in force and proposed, for the government of these improvements are based is set forth in detail, particularly with respect to the widening of Fifth avenue, separating the crossing of Fifth avenue and Forty-second street and the elimination of grade crossings by railroads. Some of these ordinances and the data on which they are based will appear in MUNICIPAL ENGINEERING from time to time.

The discussion of drainage plans shows that the department has done much to coordinate the work of the various boroughs, and the principles followed in the design of sewers in all of them are gathered together for comparison, and will be of great value to engineers elsewhere, covering as they do the conditions from thickly covered lower Manhattan to seashore villages.

Water supply, street openings and discontinuances and the daily work of constructing public improvements are covered by statistical tables and their explanations. The delay between payment by the city for construction and collection of the assessments from property owners and the reasons therefor are shown clearly, and the arguments should lead to improvement in this regard.

The report of the engineer in charge of the division of franchises, Harry P. Nichols, shows the great advantages of expert technical control of the form of franchises and of their modifications. Much is done each year in improving the franchises now in existence and in putting new franchises into better shape before granting them, and the details are shown clearly and well in the hundred pages of his report. Some of the work will be discussed later in more detail.

New Publications.

Modern Plumbing Illustrated.—A comprehensive and thoroughly practical work on the modern and most approved methods of plumbing construction. The standard work for plumbers, architects, builders, property owners and for boards of health and plumbing examiners. By R. M. Starbuck. Fully illustrated by 55 full-page plates. 392 pp. Cloth, $4.00. The Norman W. Henley Publishing Company, New York.

This work is a practical work, representing in the main the best modern practice in plumbing and water supply. Naturally, the questions of drainage and sewerage occupy first place. On these questions the author has followed the requirements of the City of New York and other important cities, as well as the requirements of the United States, in all matters of drainage and sanitation.

A special feature of the work is the liberal scale drawings, which cover almost every imaginable condition likely to come

before the plumber, architect or sanitary engineer.

In treating city work, sewerage occupies first place, but in dealing with country work the author has entered quite fully into the question of water supply. Here also the question of sewage disposal has been treated at considerable length, showing the various systems that have proved acceptable under varying conditions.

The book will be found valuable to the plumber in his actual work, giving special details as to size and weight of pipes required under different conditions. To the architect it will be found suggestive and aid in preparing plans and directing and superintending work; to the owner in aiding him to secure the best and simplest system for his buildings; to the plumbing inspector the many practical features it presents will remind him of the methods to be pursued to secure safe and healthful sanitary conditions, and to the plumbers practical methods of executing the work.

The reviewer would suggest that in future editions all of the examples of poor practice be properly labeled. Some of them are so marked on the plates and all are properly described, but the careless reader is likely to accept some of the drawings as showing good practice because they appear on the same plate with good designs, not stopping to note their condemnation in the text. There are occasional plates purporting to show good practice concerning which there is room for difference of opinion, such as fresh air inlet designs, some of the traps and venting, etc., but all those shown are used by plumbers of high standing and the book is remarkably high throughout in the quality of the work described.

The Peru of Today and the Peru of Tomorrow. By Prof. Emile Guarini, of Lima. Paper, 16 pp. 1 franc. H. Dunod, Paris.

This is a description in French of the republic of Peru, South America, showing the natural advantages of the district. The author ascribes the slow development of the country and the concentration of population along the coast and in certain valleys to the lack of transportation facilities and the difficulties in the way of installing them, due to elevations, lack of fuel, etc. He computes the expense of production of power and distribution through the electrical current, using coal for fuel, and calls attention to the numerous sources of water power in the streams coming from the mountains, with enormous falls in short distances, and computes the cost of supplying power from these sources and distributing it by electricity, to show the economy of this method of providing the transportation facilities and the power for manufacturing industries which the country has heretofore lacked. He also shows the advantages of the telpherage system of transportation, especially where steep gradients make railways difficult, if not impossible.

Problems of the Panama Canal; including climatology of the Isthmus, physics and hydraulics of the river Chagres, cut at the Continental Divide and discussion of plans for the waterway. By Brig.-Gen. Henry L. Abbot, U. S. A., retired. 248 pp. Cloth, $1.50, net. The Macmillan Company, New York City.

General Abbott is perhaps the best fitted man by training and experience to write a book upon the Panama canal that could be selected. One of the early acts of the New Panama Canal Company, which was organized in 1894, to carry on the work of the insolvent Interoceanic Canal Company, was the appointment of a technical committee composed of seven French and seven foreign engineers, of which General Abbott was one. He was also chosen by the Board of Directors as its representative on the commission appointed in 1898 to report upon the progress of the work and thereafter continued to act as consulting engineer of the company until its property was transferred to the United States. He is thus thoroughly familiar with all the projects and plans, with the work accomplished and with the physical, financial and engineering conditions. As a consequence his book contains an authoritative history of the work from the beginning of the new company to the transfer of the canal to the United States. It has also careful comparisons of the prominent canal routes between the Atlantic and the Pacific and gives a full discussion of the physical conditions on the Isthmus, the principal engineering problems and the various projects for solving them. Any one who wishes to become familiar with the canal history and problems will find the book a reliable guide and preparation for a detailed study of the plans as they are now being developed under the United States Government. These plans are necessarily changed from those under which construction was carried on by the first company, because the conditions as regards requirements of size of vessels, speed, etc., as well as necessity of fitting the cost to the prospective returns are now quite different, but the new plans must take into account the work already done and must be based upon the same studies of the physical conditions, so that the book will be most valuable in securing a basis for studying the new work. New editions from time to time bring the book down to date.

The Principles and Practice of Surveying. Vol. II, Higher Surveying. By Charles B. Breed and George L. Hosmer, assistant professors of civil engineering, Massachusetts Institute of Technology. Cloth, 449 pp., 162 figures. $2.50. John Wiley & Sons, New York City.

The authors have divided their subject into four parts, such that the development is logical and practical. They write much of the book with the certainty which

comes of practical experience and careful study, and have called upon experts in lines in which they were not so sure of themselves for criticism, assistance, and, in one or two cases, for full preparation of chapters. The total result, while lacking in practical detail in a few lines, is one of the most satisfactory books upon higher surveying that the writer has examined.

The first part has as its subject the control of the survey, and sketches rapidly, yet carefully, the methods of geodetic surveying and precise leveling, which have laid the foundation of the work to be described later. The accuracy of this work and the control of the accuracy of the detailed surveys later described are brought out, and details of apparatus and methods are given with sufficient accuracy for this purpose, and to serve where similar apparatus and methods can be used to advantage on the more detailed work. The practical work in the details of work on triangulation, including measurements of angles, azimuths, altitudes, longitudes and latitudes, and the work of precise, trigonometric and barometric leveling are described with varying attention to detail, some operations, such as base-line measurement, being dismissed with a few words.

The second part fills in topographical details in chapters devoted respectively to the stadia, the plane table and the photographic camera. There is also an interesting chapter by Prof. D. W. Johnson on the relation of geology to topography.

The third part treats hydrographic surveying and stream gauging in two rather full chapters, the latter by H. K. Barrows, an engineer on the U. S. Geological Survey.

The fourth part constructs and finishes the maps of the survey, one chapter showing the qualities of the various map projections and the other giving some general directions regarding plotting and finishing topographic and hydrographic maps.

The usual tables follow, and the book closes with the specifications for a topographical map which are used by a prominent firm of landscape architects.

ORGANIZATIONS AND INDIVIDUALS

American Society of Municipal Improvements—Cincinnati Conference—Improvement Association—Technical Meetings—Civil Service—Alexander Potter—Personal Notes

American Society of Municipal Improvements.

The program of the sessions of the convention of the American Society of Municipal Improvements, to be held in Little Rock, Ark., November 9 to 11, with a visit to Memphis on the 12th, promises to be quite as absorbing and instructive as the program for the entertainment features, which was given in this department last month.

The morning session of the 9th, Tuesday, contains addresses from Mayor John H. Tuohey and H. L. Remmel, the president of the Board of Trade, and the usual official business.

The following papers are set for the afternoon session, beginning at 2 P. M.:

Report of Committee on Municipal Franchises, "Effect of State Public Service Commissions upon Municipal Franchises," by C. C. Brown, editor of MUNICIPAL ENGINEERING, chairman.

"Proposed Franchise for a Public Service Corporation," by C. C. Brown.

Report of Committee on Taxation and Assessment, by R. W. Ball, City Engineer, Henderson, Ky., chairman.

Report of Committee on Review, by C. D. Pollock, Assistant Engineer, Bureau of Highways, New York, chairman.

Report of Committee on Municipal Data and Statistics, by J. W. Howard, Consulting Engineer, New York, chairman.

Report of Committee on Park Development and Maintenance, "The Function of the Playground in the Public Park," by A. M. Reynolds, Chief Engineer Essex County (N. J.) Park Commission, chairman.

"Public Parks and Street Trees in City Planning, by William Solotaroff, Superintendent East Orange Shade Tree Commission.

"Parks as Conservators of Natural Resources," by E. A. Harper, Kansas City, Mo.

Report of Committee on Fire Protection, by Alcide Chausse, City Architect and Superintendent of Buildings, Montreal, chairman.

Report of Committee on Water Works and Water Supply, review of the year, by J. L. Ludlow, Consulting Engineer, Winston-Salem, N. C., chairman.

Water Supply Paper, by Morris R. Sherrerd, Chief Engineer Department of Public Works, Newark, N. J.

"Small Gravity Water Systems," by Lucien Buck, Consulting Engineer, Canton, N. C.

The evening session has the following:

Report of Committee on Sewerage and Sanitation, by George C. Whipple, Consulting Engineer, New York, chairman.

"Some Problems of Trade Waste Disposal," by Robert Spurr Weston, Consulting Engineer, Boston, Mass.

"Disinfection of Sewage and Sewage Effluents," by Prof. Earl B. Phelps, Massachusetts Institute of Technology.

"What the State of New Jersey is Doing to Purify Its Streams," by H. M. Herbert, Engineer of New Jersey State Board of Health.

"Education in Municipal Sanitation," by Prof. Henry N. Ogden, Cornell University.

"Materials for Sewer Inverts," by E. S. Rankin, Engineer of Sewers and Drains, Newark, N. J.

"Public Comfort Stations," by Horace Andrews, Consulting Engineer, Albany, N. Y.

Report of Committee on City Government and Legislation, by Horace Andrews, Consulting Engineer, Albany, N. Y., chairman.

"Commission Government," by William Doran, Commissioner of Streets and Public Property, Dallas, Texas.

Report of Committee on Disposition of Garbage and Street Cleaning, giving data from municipalities, by Louis L. Tribus, Superintendent of Public Works, Richmond Borough, New York, chairman.

"Garbage Reduction and Disposal of the By-Products," by Charles S. Wheelwright, President International Continuous Filter Press Company.

"Refuse Disposal by High Temperature Destructor System," by Col. William F. Morse, Sanitary Engineer, New York.

"Brick Pavements, Good and Bad" (with lantern slides), by Will P. Blair, Indianapolis, Secretary National Paving Brick Manufacturers' Association.

The morning of November 10, Wednesday, will be devoted to a trip to industrial plants by train, as set forth in detail last month, and the evening to a reception and luncheon. The afternoon has the following list of papers.

"Some Notes on Toronto Pavements," by C. H. Rust, City Engineer, Toronto, Ont.

"Pavements and Their Grade Limitations in the Borough of the Bronx, New York," by S. C. Thompson, Principal Assistant Engineer, Bureau of Highways, Borough of the Bronx, New York.

"Pavement Crowns and Concrete Foundations," by George C. Warren, President Warren Bros. Company.

"Pavements Without Concrete Base; Their Durability and Retention of Evenness," by Paul E. Green, Division Engineer of Streets, Chicago.

"Gutter Culverts on Paved Streets," by F. V. P. Ellsworth, City Engineer, Hot Springs, Ark.

"Gutter Culverts on Paved Streets," by J. H. Weatherford, City Engineer, Memphis, Tenn.

"Care of Surface Water at Street Intersections," by S. D. Newton, City Engineer, Knoxville, Tenn.

Report of nominating committee.

Election of officers.

Report of committee on next place of meeting.

Selection of next place of meeting.

The morning of Thursday, November 11, is devoted to the following papers:

"Creosote Oil for Wood Block Pavements," by J. N. Hazlehurst, Consulting Engineer, Atlanta, Ga.

"Bituminous Pavements on Macadam Base," by Linn White, Engineer South Park Commission, Chicago, Ill.

"Bitumens Used in Pavements," by J. W. Howard, Consulting Engineer, New York.

"Three Years' Experience with Oiling Roads," by F. A. Reimer, City Engineer, East Orange, N. J.

"Some Observations on Asphalt Paving and Some Present Needs," by Harry Tipper, of the Texas Company, New York.

"Street Railway Location and Construction, and Paving Between Tracks," by J. N. Ambler, City Engineer, Winston, N. C.

"Advantages and Disadvantages of Alley Systems for Large Cities," by William A. Howell, Chief Engineer of Street Department, Newark, N. J.

"Some Fundamentals," by F. D. Brown, City Engineer, Shawnee, Okla.

The afternoon street car ride was described in this department last month. The evening session will be used as an overflow from the very full programs of the preceding sessions and for final business. A list of questions for discussion is presented, to which some time may also be devoted. This list is as follows:

Durability of concrete pavements; especially in comparison with brick; also use of expansion joints in such pavements.

How to prevent settling and distortion of curved cement curbs at street corners.

Extent of and success with brick pavements without concrete base.

What is most satisfactory pavement for business streets with grades of 7 per cent. or over.

Relative merits of the different bitumens used in constructing and maintaining streets; from actual experience.

Methods of handling gutter water on paved streets at intersections where there are no sewers to receive it. (Carrying it under intersecting pavements by culverts, etc.)

Principles involved in and objects aimed at in designing public parks and playgrounds.

Friday morning the delegates will adjourn in a body to Memphis, Tenn., and will be given a reception and a trip round the city by the Business Men's Club and the city officials.

There will be a number of exhibits of municipal appliances and materials in the city hall. This has been one of the interesting and valuable adjuncts of the convention at all the recent sessions, and its continuance will be welcomed.

The sessions and the exhibit are both located in the new city hall, which is one of the distinguishing features of Little Rock.

Usually the early part of November is most beautiful in the South, and the ladies are urgently invited by the local committee. Mrs. E. A. Kingsley is the chairman of a committee which will take them in charge during the few hours when the convention is in session as well as during the entertainment seasons.

To make the Memphis trip easy, those from the North and East should purchase tickets to Little Rock by way of Memphis and the Rock Island from Memphis to Little Rock. Those coming through Kansas City buy tickets reading from Kansas

City to Little Rock by the 'Frisco lines. Hot Sprfngs, Ark., has special excursion rates from many cities, and it may be possible for delegates to take advantage of them. Inquiry should be made concerning them in any event. Those living in the Southwestern Passenger Association district can secure certificates when purchasing tickets entitling them to return at one-third fare.

Send E. A. Kingsley, Superintendent of Public Works, Little Rock, Ark., a card saying that you are coming and what ladies will come with you, and one to the Hotel Marion engaging rooms.

Cincinnati Conference for Good City Government.

Among the important subjects to be considered at the joint meeting of the National Municipal League and the American Civic Association to be held at Cincinnati, Ohio, November 23-26, are the choice of elective municipal officials, municipal health, immigration and the municipality, the liquor problem, college instruction in municipal government, municipal electoral reform, franchises, etc.

Called an Improvement Association.

The Clinton Hill Improvement Association at Newark, N. J., held a "kickers' night," October 11, at which front seats were reserved for knockers and men with a grouch. Pale green invitation cards were sent out to members of the association, and for use in case the members had overlooked something in the community to feel sore about the following hints were offered:

If your street needs paving, come and kick.
If your street isn't rightly cleaned or brightly lighted, come and kick.
If your car service is bad, come and kick.
If your "kiddies" are not getting right treatment in school, come and kick.

Technical Meetings.

The annual convention of the National Society for the Promotion of Industrial Education will be held at Milwaukee, Wis., Dec. 1, 2 and 3. James C. Monaghan, secretary, 20 West Forty-fourth street, New York City.

The annual meeting of the New Jersey Sanitary Association will be held at Laurel-in-the-Pines, Lakewood, N. J., Dec. 3 and 4. J. A. Exton, secretary, 75 Beech street, Arlington, N. J.

The annual meeting of the American Society of Mechanical Engineers will be held in New York City Dec. 6. Wm. H. Ross, secretary, 154 Nassau street, New York City.

The annual meeting of the American Society of Chemical Engineers will be held at Philadelphia, Pa., Dec. 8, 9 and 10. J. C. Olsen, secretary, Polytechnic Institute, Brooklyn, N. Y.

The annual meeting of the Association of American Portland Cement Manufacturers will be held in New York City Dec. 14 and 15. Percy H. Wilson, secretary, Land Title Bldg., Philadelphia.

The tenth annual meeting of the National Civic Federation will be held in New York City Nov. 22 and 23. D. L. Cease, secretary.

The third annual Cement Show will be held in the Coliseum, at Chicago, Ill., Feb. 18 to 26 inclusive, 1910. While the show is in progress seven and perhaps more allied organizations will hold conventions, among them the following: National Association or Cement Users, Feb. 21 to 25 inclusive; American Society of Engineering Contractors, Feb. 24 to 26 inclusive; National Builders' Supply Association, Feb. 23 and 24; Illinois Society of Municipal Contractors, Feb. 24, 25 and 26; Illinois Lumber Dealers' Association, Feb. 16, 17 and 18; Interstate Mantel and Tile Dealers' Association of the United States, Feb. 15 to 19 inclusive.

The sixth annual convention and Cement Show of the Northwestern Cement Products Association will be held in St. Paul, Minn., March 1 to 6 inclusive.

The annual convention of the Iowa Association of Cement Users will be held at Cedar Rapids, Iowa, March 9, 10 and 11. Ira A. Williams, secretary.

The New York Bureau of Municipal Research publishes an interesting pamphlet under the title "How Should Public Budgets be Made?" which tells how they have been made, how they are made, and how they should be made, giving fourteen stages in budget making as they apply in New York City.

At the meeting of the Municipal Engineers of the City of New York, held October 27, Thomas H. Wiggin presented a paper on "The Design of Pressure Tunnels of the Board of Water Supply." On November 6 the society will visit the Ashokan dam of the new water supply, leaving Weehawken on the West Shore railroad at 10 A. M.

At the October 27 meeting of the New York Electrical Society, G. Herbert Condiet gave an illustrated address on "Freight Handling by Electricity."

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

November 22 to 24: Skilled draftsman, experienced in instrument work, at Frankford Arsenal, Philadelphia, Pa., at $1,400 a year, and at other arsenals and armories throughout the country, at $900 to $1,200 a year.

November 24: Miller and engineer, Uintah and Ouray Indian Agency, Utah, at $900 a year; also drainage engineer, Department of Agriculture, at $1,200 to $1,500 a year.

Alexander Potter.

Alexander Potter is a graduate of Lehigh University, and has been engaged for the twenty years since that event mainly in sewer and water engineering. He had experience in city and railroad work for some seven years before graduation, so that he entered the practice of his profession with more than the usual practical knowledge, which was supplemented with two years on sewer work in the employment of Knight & Hopkins, consulting engineers, Rome, N. Y., before he began business for himself.

ALEXANDER POTTER, C. E.
New York City.

Some of the projects with the design and construction of which he has had responsible connection are a hydro-electric plant designed and constructed for the Toluca, Mex., Electric Light and Power Co., developing 1,500 h. p., and having 25 miles of high-tension transmission; a $300,000 sewage disposal plant for Houston, Tex.; a joint trunk sewer in New Jersey, which was described in a recent volume of MUNICIPAL ENGINEERING and serves part or all of Newark, Elizabeth, Summit, West Orange, South Orange, Irvington, Vailsburg, Roselle Park, Millburn, Short Hills and Wyoming, and cost, with the connecting local sewers, $2,000,000; the first municipal water-softening and filtration plant at McKeesport, Pa., costing $250,000; a hydro-electric power plant, townsite, with water works, sewers, sewage disposal, etc., at Kimberley, Nev., etc. He has also reported upon, designed or built some twenty other projects in water supply and sewerage ranging from $70,000 to $1,000,000 in cost, located in New York, New Jersey, Pennsylvania, Ohio, Virginia, Arizona, New Mexico, etc., which show the readiness with which he adapts his designs to the existing conditions.

Mr. Potter entered the American Society of Civil Engineers as a junior member before he graduated from college, and has since passed up through various degrees. He is an honorary member of the Association of Managers of Sewage Disposal Works of Great Britain. Mr. Potter is now located at 114 Liberty street, New York City, and has recently been retained to prepare a complete design for a new sewerage system and sewage disposal plant for Chester, Pa., and new water systems for the boroughs of Bethlehem, Pa., and Princeton, N. J. He is chief engineer of the Rockland Water Works and Supply Co., to supply water to municipalities in Rockland county, New York, and consulting engineer of the New Jersey joint trunk sewer, which he spent six years in building.

Personal Notes.

Frank R. Hall has been appointed assistant city engineer at Sandusky, O.

Werner Davidson has resigned as assistant city engineer, at Cincinnati, O.

Dr. David H. Cochrane, former president of Brooklyn Polytechnic Institute, died in Brooklyn, N. Y., Oct. 4.

Carroll Miller, of Pittsburg, Pa., has become engineer of construction for the Providence (R. I.) Gas Company.

James S. McCready, mayor of Indianapolis, Ind., in 1854 and 1855, died at his home in that city, Oct. 9, aged 93 years.

James Alverson, district engineer in the city engineer's department, Spokane, Wash., has resigned to accept a position with a contracting firm in Seattle, Wash.

J. F. Headlee, E. A. Robins and George C. Thomas have been elected commissioners for the sewer and waterworks district, at Searcy, Ark.

D. W. Nager, assistant city engineer of Sandusky, O., resigned his position to accept a position with the American Bridge Company, at Chicago.

J. Otis Burrage, of San Francisco, Cal., has been retained as consulting engineer on the storm-water sewer system to be constructed in Monterey, Cal.

George P. Hilton, M. Am. Soc. C. E., vice-president of the Hilton Bridge Construction Company, died at his home in Albany, N. Y., Oct. 7, of cerebral hemorrhage.

William Barclay Parsons and Eugene Klapp, of New York City, have been retained as consulting engineers on the proposed White Rock waterworks reservoir, at Dallas, Texas.

George Wells, former chief engineer of the Youngstown & Southern Railway, has been appointed superintendent of

the waterworks system recently purchased by the city of Salem, O., from private owners.

W. S. Scott has been appointed superintendent and chemist of the water filtration plant at Sandusky, O., to succeed W. H. Durbin, who resigned to accept a position with J. W. Alvord, consulting engineer, of Chicago.

Clarence W. Hudson, consulting engineer, New York City, has been appointed professor of civil engineering in Brooklyn Polytechnic Institute, succeeding Prof. Charles M. Spofford, who is now at Massachusetts Institute of Technology.

Daniel Halladay has been appointed engineer for the Good Roads Advisory Committee, at St. Louis, Mo., which is supervising the expenditure of $3,500,000 in road improvement by the Board of Supervisors and the Highway Commission.

Charles R. Henderson has been appointed manager of the Davenport (Ia.) Water Company. Mr. Henderson was formerly superintendent of waterworks at Quincy, Ill., and for the last three years has been manager of the Waterloo (Ia.) Water Company.

Ira G. Hedrick has resigned as president of the Intercity Viaduct Company, of Kansas City, Mo., and will give his attention to private engineering practice and the development of the proposed Kansas City, St. Joseph & Excelsior Springs Railway.

Arthur H. Blanchard, M. Am. Soc. C. E., deputy engineer of the State Board of Public Roads of Rhode Island, and associate professor of civil engineering at Brown University, sailed Oct. 13 to investigate the construction and maintenance of bituminous macadam roads in France, England and Scotland. Mr. Blanchard will be gone eight months.

Walter G. Leininger, one of the engineers of the bureau of streets, of Chicago, Ill., has been announced as the successful candidate in a promotional civil service examination for the position of third assistant superintendent of streets. As all paving repairs will, in the future, be done by the city instead of being let out to contractors, Mr. Leininger, in his new position, will have charge of this work.

John O'Neil, former alderman and for several years superintendent of track elevation at Chicago, Ill., died Sept. 26, at the age of 74 years. As an alderman, Mr. O'Neil was largely instrumental in persuading the city authorities to adopt in 1892 the policy of track elevation, and to require the railways to do this work at their own expense. As a result of his activity in this matter he was appointed superintendent of track elevation, which position he held until he resigned, a few years ago.

MACHINERY AND TRADE

Wire-Cut Lug Brick.

Mr. Frank B. Dunn, after years of experience in a paving brick factory and in laying brick pavements, has confirmed his opinion that repressing is a real detriment to paving brick. One of the advantages of the repressed brick is the lugs which aid in securing good bond in the joints between bricks. After many experiments Mr. Dunn has devised a method of wire-cutting brick in the process of manufacture so as to produce lugs on the sides of the bricks or blocks without the necessity of repressing them. He claims better bricks and equally as good bond in the pavement. The Dunn Wire-Cut Lug Brick Co., Conneaut, O., have issued a catalog giving the arguments in favor of this form of brick, of which they will send copies on request. They license manufacturers of paving brick, to use the piece of apparatus required to manufacture the wire-cut lug brick and demand for the brick from customers will bring them without doubt.

Somerville's Experience with Tarvia.

The city of Somerville, Mass., has given the new methods of street construction and maintenance with tarvia a thorough and exhaustive trial. As the work has been done systematically since 1906, the year which marks the beginning of dust laying and road preservation in the vicinity of Boston, the results are of more than passing interest.

Mr. Asa B. Prichard, the street commissioner of Somerville, made public the following statement in February, 1909:

Late in the year 1906 several streets were coated with tarvia, a product of coal tar. This proved to be so successful that in 1907 tarvia was used to some extent on old streets as a surface and on new macadam as a binder. In the year 1908 twenty streets were constructed with tarvia, and many requests have been received from abutters on other streets to have their streets so constructed.

During the present season, since this statement was made, 200,000 square yards of macadam in Somerville has been treated with Tarvia B, the kind of tarvia that is used cold for suppressing dust and preserving the surface of roads already in use.

In addition to the surface treatment, over 50,000 square yards of new macadam have been built with Tarvia X. Tarvia X is a heavy grade of tarvia which is used to bind together the stone in the upper course of a macadam road, replacing the gravel or stone dust usually used. The use of tarvia for this purpose originated in

Somerville, and Lee, Thurston and Essex streets, constructed by crude experimental methods in 1906, can be seen still in excellent condition.

The streets on which tarvia is used embrace on the one hand the quiet residence streets, where the sole purpose has been to suppress the dust and give a clean, sanitary surface for the benefit of householders, and on the other, such streets as Broadway and Highland avenue, which are the main thoroughfares of the city, extending from the center to the populous towns beyond. In these cases the purpose was not merely to suppress the dust, but also to reduce the cost of maintenance, which automobile traffic made excessive under the old method.

So pleasing have the results been that there is constant pressure from the citizens of all parts of the city for the extension of the tarvia treatments. Its clean, dustless surface makes it popular with the householder, while the reduction which it brings about in cost of maintenance makes it popular also with the taxpayer.

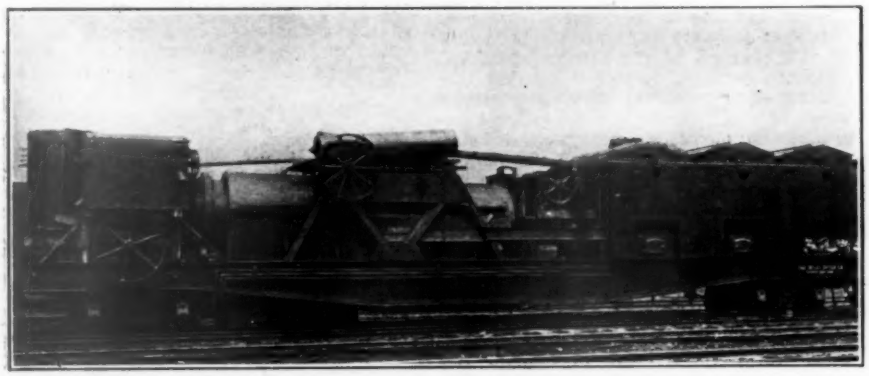
The Atlas Railroad Asphalt Plant.

The accompanying photographs show an Atlas one-car asphalt paving plant, one with the plant ready for transportation and the other ready for operation. On the fourth advertising page of this number of MUNICIPAL ENGINEERING is another photograph showing the plant in operation.

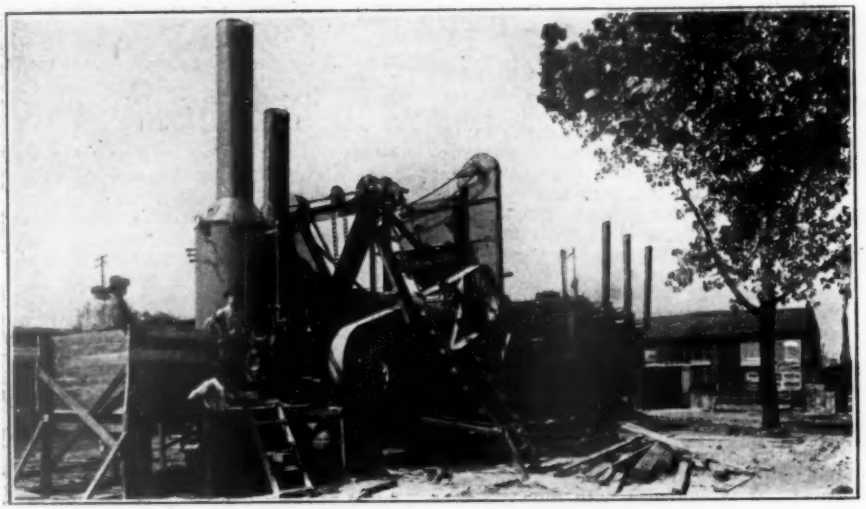
The Atlas Dryer Co., of Cleveland, O., are the manufacturers of this plant. They make portable, semi-portable and stationary asphalt paving plants of any desired capacities and the well-known Atlas dryers for drying nearly everything.

A Simple Odorless Excavator.

For use in connection with their sanitary vehicles for garbage, night soil, ashes, etc., George H. Holzbog & Bro., of Jeffersonville, Ind., have supplied themselves



ATLAS ONE-CAR ASPHALT PAVING PLANT.
Ready for Shipment.



ATLAS ONE-CAR ASPHALT PAVING PLANT.
Ready for Operation.

with a diaphragm pump of first-class manufacture, and are prepared to supply the pump, the pump handles, suction hose and delivery hose of required length, so that, with their carts, cess-pools, vaults and the like can be pumped out and the contents removed in a sanitary and odorless manner. The pump has a 3-inch suction and discharge inlet, side inlet and outlet, and can handle 3,500 gallons of liquid or semi-liquid an hour through 25 feet of suction and 200 feet of discharge hose, with two men pumping by hand. The price and the economy of operation make the outfit very attractive. Full information will be given on application to the manufacturers.

A Dynamometer Wagon for Testing Traction on Tires of Various Widths.

The question of tire widths on vehicles of all kinds is something that is of vital interest, not only to every user of vehicles, but every property owner, not only in this country, but all of the foreign countries. There is, perhaps, no one thing that has had as much consideration as the proper width of tire for use on vehicles used for commercial purposes. Many cities have, no doubt, gone to extremes on the subject of wide tires. Their purpose has been for the protection of the streets, but the great point to be arrived at is, "What is the happy medium between the narrow and the wide tires?" taking into consideration both the matter of draught and of the vehicle and the protection to the roads or streets. This tire question has become of sufficient importance for the United States Agricultural Department to employ the best experts along this line to make a practical demonstration. For this purpose they have selected Hon. Vernon Pierce, chief engineer Good Roads Division of Agricultural Department, and Prof. E. B. McCormick, dean of the State Agricultural College, Manhattan, Kan.

After a great deal of study as to a machine that would be able to register correctly the draught of the vehicle, they finally reduced their investigations to the form of blue print drawings and specifications. This having been done, the next question was to find a manufacturer capable of building this delicate machine and at the same time make a practical application of it to a vehicle. In view of the fact that the Studebaker Bros. Manufacturing Company have been furnishing the United States government with most of its vehicles since the civil war, and on account of their wide experience in vehicle construction, the blue print drawings and specifications of the self-registering instrument were turned over to them to be constructed.

The vehicle selected for use in connection with this instrument is a turntable truck. It is equipped with nine different sets of wheels, fitted with tires 1⅝ inch, 2 inch, 2½ inch, 3 inch, 3½ inch, 4 inch, 4½ inch, 5 inch and 6 inches wide. The idea is to put a load of 5,000 pounds on this wagon and make a test as to the number of pounds of power it will take to start this load, also to haul it at a dead pull on asphalt, brick and block pavement, crushed rock, macadam, gravel, sand and mud roads. This test will be made with each of the above widths of tires.

The wagon is so constructed that the pull is directly on the instrument, by means of a steel cable connecting the tongue with the instrument. In order to reduce the friction of the tongue operation to the minimum, both the tongue and the hounds are plated with polished steel, and between the tongue and the tongue hounds is set a tray of steel rollers on either side. The cable running from the tongue to the instrument passes between the set of steel rollers, enabling the cable to work with the least possible friction. The rear end of the cable is attached directly to two spiral springs which have been carefully tested as to their compression. This brings the pull directly on the springs, and as it is compressed or released a paper ribbon is being constantly unrolled from one of the rollers, passing over a steel registering needle and on to another roll, which keeps the ribbon intact until the test is completed. These rolls are operated by means of a sprocket chain passing from the rear wheel of the wagon to a small sprocket on the instrument.

The above instrument is a very difficult piece of machinery to make, and required the skill of the most expert mechanics. When the machine was completed and applied to the wagon, its workings were perfect from the start.

The tests are conducted by the United States Agricultural Department in the vicinity of Memphis, Tenn. As soon as this work has been completed a full report will be compiled by the United States Agricultural Department, and will, no doubt, be distributed without charge to all those who may be interested.

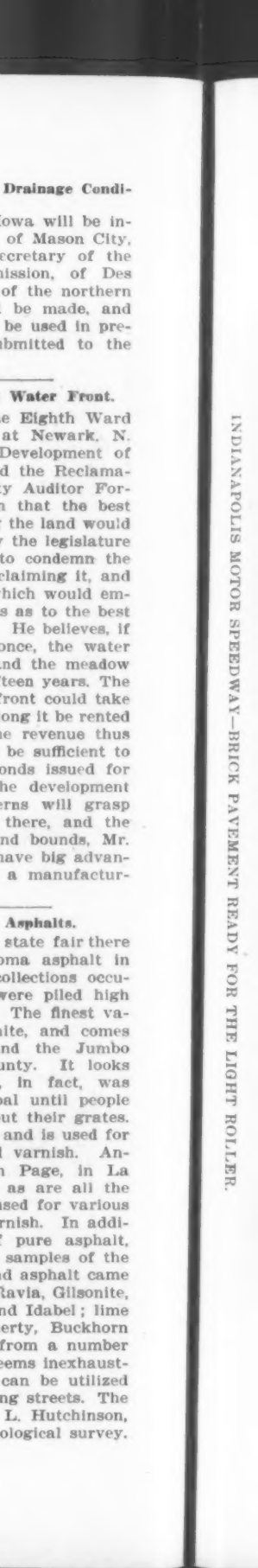
Brick on the Indianapolis Motor Speedway.

As stated in the editorial department, the accelerated test of a bituminous concrete pavement on the Indianapolis speedway, which was made in the spring automobile races, showed that a harder surface was necessary to stand the wear. One observer says that a prominent reason for the rapid wear of the pavement into ruts was the action of the rear automobile wheels as emery wheels. A slight roughness in the roadway would cause a lifting of the springless automobile, which, at the speed of the races, would keep the weight of the machine off the ground for thirty or forty feet. This resulted in an acceleration of the engine and rapid revolution of the driving wheels, the stones adhering to which, together with the roughness of the tires, caused a wearing action

INDIANAPOLIS MOTOR SPEEDWAY—SPREADING THE 2-INCH SAND CUSHION AND LAYING BRICK, OCTOBER, 1, 1909.

which soon formed the ruts which were so prominent a feature of the track. The last race, one of 300 miles, could not be finished because these ruts became such serious obstructions.

The speedway is now being paved with Culver blocks, made by the Wabash Clay Co., Veedersburg, Ind., under the rigid inspection of the National Paving Brick Manufacturers' Association, and will shortly be ready for use again. Fuller detail of the processes used will be given later. Meantime the accompanying pictures show the spreading of the 2-inch sand cushion, the laying of brick, and the brick surface ready for rolling with a 5-ton roller.



INDIANAPOLIS MOTOR SPEEDWAY—BRICK PAVEMENT READY FOR THE LIGHT ROLLER.

Qualities of Liquid Asphalt Binder.

Following is an analysis of the liquid asphalt binder furnished by the Indian Refining Co. of Cincinnati and New York, for road use, made by Dow & Smith, New York:

Specific gravity at 60 F....	.983
Equivalent to.....	12.4 Be.
Flash test (closed tester)	500 F.
Fire test.....	590 F.
Loss on heating 5 hours at 325 F.....	0.75 per cent.
Asphalt contents (100 pen. at 77 F.) (semi-asphaltic)	91.5 per cent.
Residue (50 pen. at 77 F.).	89.2 per cent.
Ductility of 50 pen, residue	4.6 cms.
Fixed carbon, original oil..	9.0 per cent.
Fixed carbon, 50 pen. residue	14.9 percent.

As shown by the ductility test, this oil possesses greater cementing powers than the samples previously examined. The ductility of the residue of 50 penetration felt after evaporation is approximately twice that of previous samples. It yields on evaporation 91.5 per cent. of a semi-asphaltic residue having a penetration of 100 at 77 F.

Comfort for the A. S. M. I. Convention.

The Hotel Marion at Little Rock, Ark., is a new six-story fireproof hotel which the traveling men say is the equal of any in St. Louis. It is located in the center of things in Little Rock, and is very reasonable in its rates, especially when the accommodations are considered. That it is popular is shown by the fact that a new 125-room annex is under construction. Those who are going to the convention of the American Society of Municipal Improvements, to be held in Little Rock, November 9, 10 and 11, will find it greatly to their advantage to send promptly to Homer Wilson, manager of the Marion Hotel Co., asking him to reserve rooms for them for use during the convention. Rooms with bath cost $2.50 and without $1 a day and upward. The hotel has an excellent cafe, and will be the popular stopping place for members and their friends. It is the nearest first-class hotel to the city hall, which is the place of meeting of the convention.

State Investigation of Iowa Drainage Conditions.

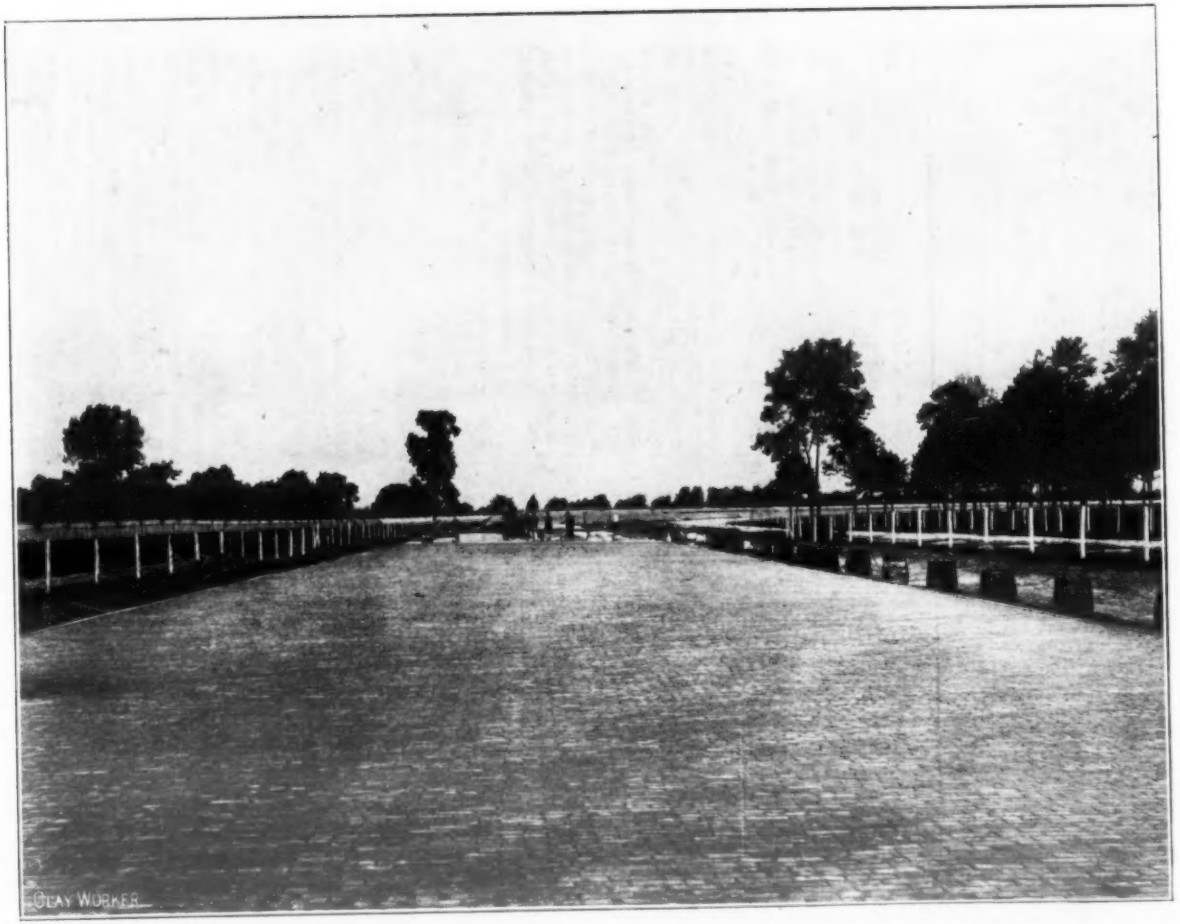
Drainage conditions in Iowa will be investigated by I. W. Keerl, of Mason City, and George L. Dobson, secretary of the Iowa Conservation Commission, of Des Moines. A complete tour of the northern counties of the State will be made, and the material gathered will be used in preparing a report to be submitted to the next general assembly.

Development of Newark's Water Front.

In his address before the Eighth Ward Improvement Association at Newark, N. J., October 15, on "The Development of Newark's Water Front and the Reclamation of the Meadows," City Auditor Forman expressed the opinion that the best way to go about reclaiming the land would be to have a bill passed by the legislature giving the city the right to condemn the land for the purpose of reclaiming it, and to appoint a commission which would employ experts to devise plans as to the best way to go about the work. He believes, if the work were begun at once, the water front could be developed and the meadow land reclaimed in ten or fifteen years. The development of the water front could take place first, and privileges along it be rented to private individuals. The revenue thus derived, he believes, would be sufficient to pay the interest on the bonds issued for the work. As soon as the development takes place, private concerns will grasp the opportunity to locate there, and the city will grow by leaps and bounds, Mr. Forman stated, as it will have big advantages over other cities as a manufacturing center.

Exhibit of Oklahoma Asphalts.

At the recent Oklahoma state fair there was an exhibit of Oklahoma asphalt in the mineral booth. The collections occupied three tables, which were piled high with all kinds of asphalt. The finest variety is known as Impsonite, and comes from near Tuskahoma and the Jumbo mines in Pushmataha county. It looks like anthracite coal, and, in fact, was burned in the place of coal until people found out that it burned out their grates. It is of a very high grade, and is used for roofing, mineral paint and varnish. Another asphalt comes from Page, in La Flore county, and it also, as are all the pure forms of asphalt, is used for various purposes of roofing and varnish. In addition to these varieties of pure asphalt, there are a dozen or more samples of the various rock asphalts. Sand asphalt came from Ardmore, Ada, Roff, Ravia, Gilsonite, Dougherty, Loco, Garvin and Idabel; lime asphalt came from Dougherty, Buckhorn and Ravia; shale asphalt from a number of localities. The supply seems inexhaustible. All of the material can be utilized for making roads and paving streets. The collection was made by L. L. Hutchinson, assistant director of the geological survey.



INDIANAPOLIS MOTOR SPEEDWAY—BRICK PAVEMENT READY FOR THE LIGHT ROLLER.

Electric Street and Interurban Railway for El Paso.

A charter has been filed in the secretary of state's office at Austin, Texas, by the El Paso & Fort Hancock Railway Company, and a contract will soon be let for building an electric railway down the valley of the Rio Grande between El Paso and Fort Hancock, a distance of about sixty miles. The survey for the route of the proposed road has been made, and it is said to be amply financed. The territory which it will penetrate is devoted largely to irrigated gardens and farms, and the road will do a freight as well as a passenger traffic. The company has a capital stock of $100,000. The incorporators are C. E. Kelly, Richard Caples, Felix Martinez, W. B. Latta, Richard Burges and Thomas O'Keefe, all of El Paso.

The orders for the material and equipment for the electric street railway system that is to be constructed in Corpus Christi have been placed by Daniel Hewitt, of Salina, Kan., who recently obtained a franchise for the enterprise. The system will cover the principal streets, and will later be extended to the Epworth League encampment grounds.

Trade Publications.

Continuous reinforced concrete pipe, made by the Meriwether system, is the subject of a well-written and illustrated booklet issued by the Lock Joint Pipe Co.

The Wolverine Portland Cement Co., Coldwater, Mich., issue a profusely illustrated booklet giving a history of the company, a description of the process of manufacture of the cement, analyses and tests, and photographs of work in which it has been used.

The Chain Belt Co., Milwaukee, Wis., send their blue book, general catalog No. 37, listing and illustrating their chains, belts and elevating and conveying machinery.

Bulletin 65 of the Universal Portland Cement Co. shows on its cover a handsome concrete mantel and a bench of artistic design.

The Lehigh Portland Cement Co. tell "What They Discovered at the North Pole," in a dainty booklet "By Dr. Moss."

Trade Notes.

ASPHALT.

New York City—George W. Crichfield, of Jersey City, N. J., applied, Oct. 11, for the appointment of a receiver for the United States and Venezuela Company, a New Jersey corporation which formerly operated asphalt fields in Venezuela. Ralph T. Rokeby, president of the asphalt company, with other directors, has filed a bill in the Court of Chancery for the continuance of themselves as trustees to settle its affairs. Mr. Crichfield opposed the application and asked for the appointment of a receiver, on the ground that the directors, having allowed claims worth $1,500,000 to be settled for $475,000, were not the proper persons to wind up the company's business.

St. Joseph, Mo.—This city purchased an asphalt repair plant, Sept. 26, from the American Asphaltum and Rubber Co., of Chicago, for $4,000.

BRICK.

Bloomfield, Ind.—The Bloomfield Vitrified Brick and Tile Co. let a contract recently for the construction of four large kilns.

Fort Smith, Ark.—The Fort Smith Vitrified Brick Co. let a contract recently for the construction of 20 down-draft kilns to William Crumlic, of Springfield, Ill.

Independence, Kas.—Another paving brick plant is contemplated here, according to press reports.

Frostburg, Md.—A new paving brick plant will be erected by Mayer Bros.

CEMENT.

Jersey City, N. J.—The Warren Portland Cement Co., 15 Exchange Place, has been incorporated to manufacture Portland cement, artificial stone, building blocks, etc., by I. R. Coles, John W. Melock and Mortimer L. Sweeney.

Norfolk, Va.—The Norfolk Portland Cement Company, recently organized here as an auxiliary concern to the American Cement Co., will own and operate a cement plant here. Plans for the construction of the plant have been prepared, and it will occupy a site of 14 acres on the southern branch of the Elizabeth river.

Bowling Green, Ky.—(Special)—W. W. Phillips desires the address of a firm of engineers who construct Portland cement plants, or who will take a contract for constructing the plant and furnishing all necessary machinery to put the plant in operation.

CONCRETE BLOCKS.

Rockport, Ind.—The Rockport Drain Tile Co. has been incorporated to manufacture and sell clay products, including drain tile, by Joseph A. Long, William C. Elston and Allen P. Rice.

Humboldt, Ia.—A cement tile plant is to be erected this fall.

Davenport, Ia.—The Tri-City Concrete Company has been organized to manufacture concrete blocks. J. G. Birtness is at the head of the company. The machinery of a plant that has gone out of business will be taken over by the company.

Bouton, Ia.—Bryan Bros., of Perry, will establish a branch of their cement block plant here.

LIGHT, HEAT AND POWER.

Calhoun, S. C.—The Calhoun Power Mfg. Co. has been incorporated by J. W. Walker and D. G. Zeigler, of this city, to engage in general construction of dams and other public works of construction.

PROPOSED PURCHASE OF MACHINERY.

Emporia, Kas.—(Special.)—J. H. Stoefelter advises us that he desires to purchase a dredge of some sort that will remove solidly compacted gravel from the bed of the river under water from 1 to 8-ft. deep. Cost and efficiency are main items.

PROPOSED PURCHASE OF MATERIALS.

Burlington, Ia.—(Special.)—F. E. Lundell advises us that he desires to purchase water-proofing materials.

MISCELLANEOUS.

Ellettsville, Ind.—The Thompson & Sandy Stone Co. has been incorporated to own and operate stone quarries, etc., by Albert J. Thompson, William P. Sandy and Martha A. Sandy.

Chicago, Ill.—The Cady Construction Co. has been incorporated to conduct a general contracting, paving, dredging and construction business, by L. V. Cady, E. J. Snackenberg and Edward D. Pray.

Philadelphia, Pa.—The American Union Construction Co. has been incorporated to build, construct and operate electric railways, bridges, etc., by Francis W. Strickland, Austin G. Geary and Thomas McAuliffe, all of Boston.

SEWER PIPE.

Sedalia, Mo.—The Sedalia Clay Manufacturing Co. has been incorporated to manufacture brick, sewer tile, fireproofing, drain and roofing tile, fence posts, interlocking tile pottery, and terra cotta clay novelties, by J. F. and Glennie L. McCuster, Jerome Moyer, H. K. Dente and C. L. Wilson.

Alliance, O.—Ross Rue is organizing a company to erect a brick and sewer plant near here.

Patents Concerning Foundations and Excavations.

853,581. Apparatus for Inserting Piles. George G. Fryer, Syracuse, N. Y.

855,030. Metal Sheet Piling. Julius R. Wemlinger, Brooklyn, N. Y.

858,742. Pile and Method of Forming and Sinking It. Daniel E. Moran, Mendham, N. J.

859,295. Sheet Piling. Truman Hill, Chicago, Ill.

860,053. Interlocking Means for Sheet Piling. George E. Nye, Chicago, Ill.

862,284. Method of Constructing Sunken Structures. Julius W. Schaub, Chicago, Ill.

863,016 Collapsible Pile Case or Former. Thomas Bilyeu and Dave Hirstel, Portland, Ore.

863,614. Apparatus for Driving Piles Under Water. Simon Lake, Berlin, Germany.

863,837. Sheet Piling. Francis R. Dravo, Sewickley, Pa.

863,886. Metal Sheet Piling. Frank W. Skinner, New York City.

866,082. Sheet Metal Piling. Richard H. Stevens, Munhall, Pa.

866,232. Construction of Sheet Piling, etc. Frank W. Skinner, Tompkinsville, N. Y.

869,336. Concrete Pile and Means for Driving Same. John Stewart, Pittsburg, Pa.

871,582. Sheet Piling. Luther P. Friestedt, Chicago, Ill.

872,093. Excavating for Concrete Piles, etc. William J. Stewart, Belfast, Ireland.

873,069. Caisson Construction (concrete). Alex. Z. McLeod, New York, N. Y.

876,306. Sheet Piling. Jesse T. Pyle, Amarillo, Tex.

873,581. Subaqueous Concrete Construction. Finlay R. McQueen, Minneapolis, Minn.

877,008. Sheet Metal Piling. Frank W. Skinner, New York, N. Y.

878,141. Metallic Sheet Piling Driving Point. George W. Jackson, Chicago, Ill.

878,765. Concrete Pile. Jaquelin M. Braxton, Key West, Fla.

878,773. Metal Sheet Piling. Manley W. Cluxton, Chicago, Ill.

879,792. Interlocking Sheet Piling. George E. Nye, Chicago, Ill.

884,668. Concrete Pile Covering. Frederick A. Koetitz, San Francisco, Cal.

888,085. Metal Piling. James J. Harold, Jersey City, N. J.

888,135. Metal Sheet Piling. Robert B. Woodworth, Pittsburg, Pa.

888,899. Metal Sheet Piling. George W. Jackson, Chicago, Ill.

890,765. Apparatus for Sinking Concrete Piles. Frank B. Gilbreth, New York, N. Y.

898,510. Connection for (Steel) Culvert Sections. Julius H. Schlafly, Canton, O.

903,126. Process of Forming Concrete Piles. Richard J. Beall, Jr., Washington, D. C.

903,246. Concrete Pile and Method of Forming the Same. Maxwell M. Upson, New York, N. Y.

904,156. Interlocking Sheet Piling. Edwin E. Slick, Pittsburg, Pa.

905,153. Excavating Apparatus. Morris M. Defrees, Indianapolis, Ind.

906,139. Dumping Machinery for Excavating Buckets. Charles C. Jacobs, Chicago, Ill.

907,356, 907,357. Subaqueous Tunnel and Method of Sinking. Olaf Hoff, New York and Tarrytown, N. Y.

907,361. Excavating and Dredging Machine. Daniel Hogan, Instanter, Pa.

Patents Concerning Electric Transmission and Light.

855,492. Conduit for Electric Railways. John S. Alexander, New York, N. Y.

864,958. Street Lamp. John Doyle, New York, N. Y.

872,958. Street Lamp. Ragland Momand, New York, N. Y.

890,285. Conduit Cover. Hubert Krautz, New York, N. Y.

896,914. Apparatus for Molding Conduits in Concrete, etc. David L. Hough, New York, N. Y.

897,190. Reinforced Monolithic Conduit. James M. Boyle, New York, N. Y.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Galveston, Tex.—Voted to issue $500,000 for constructing good roads.

Manitowoc, Wis.—The city council voted to pave Washington st.

Sandusky, O.—Council has decided to pave Neil st. with brick.

Kansas City, Mo.—A new boulevard in Paseo extension is contemplated.

Juniata, Pa.—Will vote in November on the issue of bonds for paving Fourth ave.

Sanford, Fla.—Voted Oct. 11 to issue bonds for road and bridge construction.

Ellensburg, Wash.—Council has adopted plans for improving the streets at a cost of $50,000.

Windsor Locks, Conn.—About $20,000 will be expended for the construction of roads.

Palatka, Fla.—The county commissioners contemplate expending about $100,000 for road improvements.

Cicero, Ill.—Brick and macadam paving is contemplated for all of the streets in Morton Park.

Columbus, O.—An ordinance has been passed providing for the construction of paving in 20 streets.

Lewiston, Idaho—The organization of a new paving district comprising approximately 18,000-sq. yds. is contemplated.

Johnstown, Pa.—An ordinance has been passed providing for the appropriation of $140,000 for street improvements.

Pekin, Ill.—About 10,000-sq. yds. of vitrified brick paving is contemplated in Susannah, Broadway and Sixth sts.

Jacksonville, Fla.—City council passed an ordinance, Oct. 10, to construct sidewalks at a cost of about $100,000.

Bay City, Mich.—Preliminary steps have been taken toward finishing the boulevard system between this city and Saginaw.

Tacoma, Wash.—The council contemplates paving Yakima ave. with asphalt, with brick gutters and concrete and granite curbing, at a cost of $128,036.

Sioux Falls, S. D.—About 4,500-sq. yds. of paving, with Sioux Falls jasper blocks, is contemplated in Sixth st.

Lincoln, Neb.—Brick paving is advocated by Alderman Castle to replace the asphalt paving in O st. between 16th and 27th sts.

Bemidji, Minn.—A hearing will be held Dec. 4 on a petition presented to the district court asking for a judicial road in this and Hubbard counties.

Oklahoma City, Okla.—Plans have been presented to the city council by cy. engr. Burke for new street and sewer improvements to cost about $180,000.

Normal, Ill.—The city engineer has been directed to prepare estimates for paving Broadway with Poston brick on concrete base, with concrete curb and gutter.

St. Joseph, Mo.—An ordinance has been introduced providing for asphalt paving on the old brick surface in Francis st. from 10th to 12th.

Philadelphia, Pa.—A committee of the Market Street Business Men's Association called upon Mayor Reyburn, Oct. 16, to urge the paving of Market st. west of 16th with wood blocks.

Peoria, Ill.—A resolution has been passed to pave Bryan st. with macadam. Cy. engr. Belsley was also directed to prepare estimates for resurfacing with asphalt Madison and Perry aves. and paving W. Armstrong st. with asphalt.

Puyallup, Wash.—Paving is contemplated for W. Pioneer ave.

Erie, Pa.—Mayor Liebel has approved estimates for curbing W. 24th st.

Hamilton, O.—L. A. Dillon, cy. engr., has submitted plans and specifications for paving East ave. from High st. to Grand boulevard with asphalt, bitulithic, bituminous macadam, vitrified shale brick or creosoted wood blocks.

CONTRACTS TO BE LET.

Rushville, Ind.—Bids are asked until Nov. 3 for constructing 2 roads. George W. Cann, co. audt.

Brazil, Ind.—Bids are asked until Nov. 2 for constructing a gravel road. J. L. Burns, co. audt.

Madison, Wis.—Bids are asked until Nov. 10 for improving Washington ave. O. S. Norsman, cy. clk.

Jefferson, Ia.—Bids are asked until Nov. 9 for graveling Adams st. B. S. McCully, cy. clk.

Fowler, Ind.—Bids are asked until Nov. 4 for constructing a stone road. L. Shipman, co. audt.

Rockville, Ind.—Bids are asked until Nov. 2 for constructing 2 gravel roads. H. A. Henderson, co. audt.

Lafayette, Ind.—Bids are asked until Nov. 4 for constructing gravel roads. John P. Foresman, co. audt.

Boonville, Ind.—Bids are asked until Dec. 6 for constructing 3 gravel roads. Ray F. Cherry, co. audt.

Laporte, Ind.—Bids are asked until Nov. 4 for constructing a macadamized road. Charles W. Miller, co. aud.

Kansas City, Kas.—Bids are asked until Nov. 8 for macadamizing 3½-mls. of the Kaw Valley road. Co. clk.

Saltsburg, Pa.—Bids are asked until Nov. 4 for grading, curbing and paving Point st. Prest. boro coun.

Petersburg, Ind.—Bids are asked until Nov. 2 for constructing 6 rock roads. Frank P. Bilderback. co. audt.

Paoli, Ind.—Bids are asked until Nov. 2 for constructing 2 roads in Greenfield twp. Alvin B. Ham, co. audt.

Vicksburg, Miss.—Bids are asked until Nov. 3 for guttering and graveling Park ave. J. D. Laughlin, chancery clk.

Indianapolis, Ind.—Bids are asked until Nov. 5 for paving the sidewalks in sundry streets. Joseph T. Elliott, chmn. B. P. W.

Cleveland Heights, O.—Bids are asked until Nov. 2 for constructing cement sidewalks in Plaisted Court. Wm. G. Phare, vil. clk.

Two Rivers, Wis.—Bids are asked until Nov. 19 for grading, curbing and paving with cement part of Washington st. B. P. W.

Stillwater, Okla.—Bids are asked until Nov. 2 for paving 71,000-sq. yds. of streets with asphalt. C. A. Wood, cy. engr.

Marion, Ind.—Bids are asked until Nov. 2 for paving 3 blocks of Gallatin st. with vitrified brick. T. E. Petri, cy. engr.

Cincinnati, O.—Bids are asked until Nov. 12 for improving the Cleves and Miamitown road. Stanley Struble, prest. co. comrs.

Greenfield, Ind.—Bids are asked until Nov. 3 for constructing a cement sidewalk in E. South st. Oscar O. Bever, cy. clk.

Columbus, O.—Bids are asked until Nov. 3 for improving Carpenter, 4th, 7th and several streets. Edw. W. Hirsch, secy. B. P. S.

Charleston, S. C.—Bids are asked until Nov. 6 for vitrified brick paving at the Navy Yard here. Bureau Yds. & Docks, Navy dept., Washington, D. C.

Toledo, O.—Bids are asked until Nov. 9 for paving Knapp st. with sheet asphalt, creosoted wood blocks, or asphalt blocks. Reynold Voit, secy. B. P. S.

Salt Lake City, Utah—Bids are asked until Nov. 6 for grading, curbing and paving 3d St. in paving extension No. 61. Louis C. Kelsey, cy. engr.

Chandler, Okla.—Bids are asked until Nov. 16 for constructing a hard surface highway in Road Dist. No. 1, 30.51-mls. Co. clk.

Wabash, Ind.—Sealed bids are asked until Nov. 8 for constructing brick gutters

and sandstone curbing and cement sidewalks in Wabash st. Fremont M. Lees, cy. clk.

Puyallup, Wash.—Bids are asked until Nov. 3 for grading Birch st.

Edmonds, Wash.—Bids are asked until Nov. 4 for constructing concrete walks. Cy. clk.

Champaign, Ill.—Bids are asked until Nov. 2 for paving S. 14th st. with vitrified brick. S. C. Tucker, prest. bd. local improvements.

Brooklyn, N. Y.—Bids are asked until Nov. 3 for repaving certain streets with asphalt. Bird S. Coler, prest. boro.

CONTRACTS AWARDED.

Quincy, Ill.—Henry Reese was awarded the contract for paving 10th st., for $19,-910.

Dayton, O.—The contract for grading, graveling and curbing Stewart st. was awarded to Joseph Glaser, for $2,133.20.

Coffeyville, Kas.—The contract for paving Hickman and Grant sts. was awarded to McGuire & Stanton, for about $12,000.

Davenport, Ia.—The contract for macadamizing Hickory Grove road was awarded to John A. Littig, of this city, at $2.05 a cu. yd.

Springfield, O.—W. F. Payne was awarded a contract, Oct. 11, for paving Monroe st. with Bolan block, with grout filler, for $2,211.94.

Sioux City, Ia.—M. L. Flinn was awarded the contract for paving Clark st. with brick block on concrete base, at $2.14 a sq. yd.

Milwaukee, Wis.—The contract for constructing Sycamore st. with brick was awarded to the Badger Construction Co. at $1.94 a sq. yd.

Schenectady, N. Y.—The contract for constructing sidewalks in Lenox road was awarded, Oct. 6, to the Chaffee Contracting Co.

Beckley, W. Va.—The contract for paving and sewer construction was awarded to Wingate & McGhee, of Roanoke, Va., for about $80,000.

Marshall, Ill.—A contract for vitrified brick paving was awarded to George T. Miller, of Lebanon, Ind., for $23,601. Brazil block will be used.

Charlevoix, Mich.—The contract for constructing 18,000-sq. ft. of cement sidewalk on the Belvedere grounds was awarded to Lee Howland.

Knightstown, Ind.—J. H. Vance & Son secured the contract for constructing about 5,000-ft. of cement sidewalks at the Soldiers' and Sailors' Orphans' Home.

New Decatur, Ala.—The contract for paving Sherman st. was awarded to the Good Roads Construction Co., of Memphis, Tenn., for $15,776.

Hollywood, Cal.—The contract for paving Prospect ave. was awarded to the Barber Asphalt Paving Co., of Philadelphia, Pa., for about $100,000.

Logan, O.—Ringwald & Son, of Chillicothe, secured contracts, Oct. 8, as follows: N. Market st., $4,057.68; S. Market st., $4,649.80.

Toledo, O.—The contract for paving Parkwood ave. with asphalt blocks was awarded to the Asphalt Block Paving Co., of this city, for $14,703.98.

Mobile, Ala.—The contract for constructing 29,267-sq. yds. of creosoted wood block paving was awarded to McPoland & O'Gara, of Birmingham, Ala., for $53,354.

Alton, Ill.—The contract for paving Park, Bacon and Bond sts. was awarded to Valenti Wolf at $1.12½ a sq. yd., the lowest price ever paid in this city.

Shreveport, La.—The contract for paving Reynolds st. with bitulithic was awarded to the Southern Bitulithic Co., of Nashville, Tenn., at $2.55 a sq. yd., 5-yr. guarantee.

Milwaukee, Wis.—The Badger Construction Co. was awarded the contract for paving Sycamore st. with asphalt at $2.50 a sq. yd. The White Construction Co. bid $2.76 a sq. yd.

Toledo, O.—Paving contracts were awarded, Oct. 18, as follows: Pinewood ave., John McMahon, $6,868.66; Navarre st., Watters & Tansey, $9,358.05; Moore st., Henry Sheehan, $7,511.41.

Stockton, Cal.—The contract for improving the lower Sacramento road, about 20-mls. in length, was awarded, Oct. 5, to the City Street Improvement Co., of San Francisco, for $164,636.

Hartford, Conn.—The contract for constructing 5,300-lin. ft. of macadam-telford highway on the Boston post road was awarded to the Lane Construction Corporation, of Meriden, for $1.77 a lin. ft.

St. Paul, Minn.—The contract for paving Snelling ave. bridge over the Great Northern tracks with creosoted wooden blocks was awarded, Oct. 19, to the Republic Creosoting Co. at $1.77 a sq. yd.

Davenport, Ia.—The McCarthy Improvement Co. secured the contract for improving Davie st. as follows: Excavating, 38 cts. a cu. yd.; paving, $1.46 a sq. yd.; curbing, 30 cts. a lin, ft.

Wausaukee, Wis. — Contracts were awarded, Oct. 8, for constructing 2-mls. of road as follows: J. C. Hubbard, ½-mi. at $2.24 and ½-mi. at $1.13 per rod; Andrew Nelson, ½-mi. at $3.20 per rod; Louis Cayo, ½-mi. at 88 cts. per rod.

Ashland, Ky.—The contract for constructing 44,860-sq. yds. of vitrified brick paving, 24,490-lin. ft. combined concrete curb and gutter, 4,000-lin. ft. concrete header, with necessary catchbasins, was awarded to John Bradley, of Atlanta, Ga.

Chicago, Ill.—Contracts for constructing cement sidewalks in a number of streets were awarded, Oct. 22, to Alexander N. Todd, Thomas D. Joy & Co., Albert Graff, August Witt, J. C. Johnson & Co., Gottfried Kehl, Demling & Wendt and A. P. Larson.

Newark, N. J.—Contracts for paving 4 roads were awarded, Oct. 11, as follows: Short Hills road, $25,894.70, and Runnymede road, $18,000, M. M. Bamberger; Cedar st., Philip and Peter Jannerone, $21,-200.82; Mountainview ave. extension, Jas. Mathews, $561.

Anderson, Ind.—(Special.—The Daniels-Lyst Co., 253 Union Bldg., advises us that it has been awarded a contract for constructing walks and drains and for grading at Fort Sam Houston, Tex., for $23,919. The company is in the market for sewer pipe, cement, sand, etc.

South Bend, Ind.—Contracts were awarded, Oct. 13, as follows: Macadam paving, Howard st., from Van Buren st. to Michigan ave., C. H. Defrees; brick paving, Howard ave., from Michigan to Laporte aves., Harry N. Barnes; constructing sidewalks in Michigan and other streets, Harry N. Barnes.

Denver, Colo.—The Municipal Construction Co. was awarded the contract for constructing concrete sidewalks in South Capitol Hill Improvement Dist. No. 2, for $24,982.65. The other bids submitted were as follows: J. Fred Roberts, $26,767.13; Commonwealth Construction Co., $27,-531.13; National Construction Co., $25,-492.50.

Denver, Colo.—A contract for concrete

curbing, grading and culverts in East Denver Improvement Dist. No. 5 was awarded to J. Fred Roberts, for $129,849.80. Other bids received were as follows: Commonwealth Construction Co., $132,847.07; National Construction Co., $136,489.66; Gaffy & Keefe Construction Co., $138,932.46; Denver & Pueblo Construction Co., $141,-931.75.

Portland, Ore.—The street committee recommended, Sept. 30, the award of contracts aggregating more than $200,000, on the condition that contractors sign an agreement to maintain the pavements free of charge for five years, and that the price charged for the surfaces in no case exceed $2. The largest single contract was that for the surfacing of Division st., from E. Tenth to E. 41st sts. This is to be paved with bitulithic and the cost will be $108,-952. The original bid of the Pacific Bridge Co., the lowest bidder for the work, was $2.09 a sq. yd., but C. F. Swigert agreed, if given the contract, to make a reduction of 9 cts. a sq. yd. and to sign the contract to maintain the street for five years. Among other bids recommended for acceptance under the new condition was that of Elwood Wiles for paving E. 7th st., from Tillamook to Fremont sts., with asphalt. The bid was $48,289. The price per sq. yd. for asphalt was $2. The committee recommended that the Oregon Hassam Paving Co. be awarded the contracts for surfacing E. Morrison st. with Hassam. The company bid $20,190, and the price per sq. yd. was $1.85. This company also secured the contract for paving Broadway, from E. 24th to E. 27th sts. The bid was $35,773. The price per sq. yd. for the paving material was $1.85. No recommendations were made by the committee on the bids for the improvement of Hawthorne ave. and of Irving st. Both of these streets are to be paved with asphalt. Douglas W. Taylor is cy. engr.

SEWERS.

Minneapolis, Minn.—During 1909 17½-mis. of sewers have been constructed, including 4-mis. of trunk and 13½-mis. of lateral sewers, at a cost of $455,000.

Camden, N. J.—The Camden county grand jury indicted, Oct. 4, the Collingswood Sewerage Company for maintaining a nuisance. The indictment is the result of a petition that was presented to Prosecutor Scovel by the residents of West Collingswood, in which they prayed for relief, alleging that the gaseous odors and other noxious fumes emanating from the sewage disposal plant are a menace to the health of the residents.

Alamosa, Colo.—A proposition has been made to the farmers and ranch owners adjacent to Mosca, providing for the expenditure of $500,000 for the purpose of building 2 reservoirs at the headwaters of the Rio Grand river, near Creede, to increase the water supply of the present San Luis Canal Company, which now irrigates about 30,000 acres of land between this city and Mosca, and thus plans to irrigate an additional 30,000 acres north of Alamosa and in the district adjacent to Mosca.

CONTEMPLATED WORK.

Portage, Wis.—Voted to issue bonds for constructing a sewerage system.

Corpus Christi, Tex.—Voted to issue $142,000 bonds for constructing a sewerage system.

Mount Vernon, Ia.—The question of constructing a sewerage system is again being urged.

Canton, Ill.—The question of constructing a sewerage system and a sewage disposal plant is under consideration. C. R. Beam, cy. engr.

Traer, Ia.—The council has taken final action toward constructing a sewerage system.

Spencer, Ia.—Final action on the proposed construction of sewers will be taken Nov. 19.

Lodi, N. J.—The state board of health has approved plans for a sewage disposal plant here.

Atchison, Kas.—Resolutions have been adopted for the construction of sewers in districts N and X.

Caldwell, Kas.—Plans are being prepared for a system of sanitary sewers and a sewage disposal palnt.

Plainfield, N. J.—A resolution has been passed providing for an issue of $43,000 sewer bonds.

Pryor Creek, Okla.—Voted to issue bonds for constructing sewerage and water works systems.

Mandan, N. D.—The commissioners are seriously considering the question of constructing a sewerage system.

Bangor, Me.—A trunk sewer in Broad st. with an outlet in Penobscot river or at its mouth is contemplated.

Albemarle, N. C.—Surveys and plans are being made for constructing sewerage, water and lighting plants.

Reading, O.—Will vote Nov. 2 on the question of issuing $43,000 bonds for constructing a sewerage system.

Utica, N. Y.—The board of estimate and apportionment approved, Oct. 5, an issue of $18,000 for constructig storm sewers.

North Tonawanda, N. Y.—Plans have been completed for the extension of the Humboldt sewer and the construction of a lift.

Susquehanna, Pa.—The question of constructing a sewage disposal plant is being considered by the village council.

Belton, Tex.—The Commercial Club is said to be interested in the question of constructing a sewerage system.

Chatham, N. J.—A resolution was passed, Oct. 5, providing for the issue of $35,000 bonds for constructing a sewerage system.

Elgin, Ill.—Plans for the proposed 7th ward sewer system are being made by cy. engr. Plum, who estimates the cost at $80,000.

Indianapolis, Ind.—Plans have been completed for constructing a sewer in Parkway, from 18th to 30th sts., at a cost of $40,000.

Reidsville, N. C.—The citizens voted, Oct. 5, to issue $100,000 bonds for constructing a sewerage system. Francis Womack, mayor.

Newark, N. J.—The construction of the proposed Passaic Valley trunk sewer is advocated by Col. Black, of the United States army.

Bowling Green, O.—An ordinance has been passed to submit to vote on the question of issuing $25,000 bonds for constructing a sewage disposal plant.

Beverly, N. J.—The estimated cost of constructing sewers and a sewage disposal plant is between $50,000 and $60,000. W. T. Kirk, Jr., councilman.

South Amboy, N. J.—Will vote in November on the question of issuing $100,000 bonds for constructing a sewerage system. J. F. Fulton, cy. clk.

Romney, W. Va.—The Romney Sewerage Company has been organized to build and maintain a sewerage system, by L. C. Pancake, J. S. Zimmerman and others.

Warren, O.—(Special.)—Bert C. Smith, cy. engr., says a resolution has been passed

for constructing the Hoyt and Dickey Run trunk sewer, requiring 3,600-ft. of 12 and 15-in. pipe sewer, and for 13,000-ft. of 8 and 10-in. sanitary sewer. Bids will probably be asked late in December or early in January.

Portland, Ore.—Plans are being prepared for constructing a large sewer system in the Peninsula district, between St. John and Union aves. and the city limits.

Elmwood Place, O.—The state board of health has approved the plans of this borough for a sewerage system, and bids will be asked for soon. Village engr. Haeckle.

Bellefontaine, O.—An ordinance has been passed authorizing the issue of $15,000 bonds for preliminary work necessary to the construction of a sewerage system for the entire city.

CONTRACTS TO BE LET.

Iowa City, Ia.—Bids are asked until May 6 for constructing a sewer in Walnut st. Cy. clk.

Rockwell City, Ia.—Sealed bids are asked until Nov. 2 for constructing drain No. 1200. O. Dixon, co. audt.

Houston, Tex.—Sealed bids are asked until Nov. 8 for constructing sanitary sewers in the 5th ward. H. B. Rice, mayor.

Liberty, Tex.—Sealed bids are asked until Dec. 1 for constructing drainage ditches. J. E. Berry, chmn. drainage coms.

Indianapolis, Ind.—Bids are asked until Nov. 5 for constructing a sewer in an alley. Joseph T. Elliott, chmn. B. P. W.

Salt Lake City, Utah—Bids are asked until Nov. 5 for constructing sewer extensions Nos. 220, 225 and 228. Louis C. Kelsey, cy. engr.

Cleveland Heights, O.—Sealed bids are asked until Nov. 2 for constructing sanitary sewers in Warrensville Center road. Wm. G. Phare, vil. clk.

Cleveland, O.—Sealed bids are asked until Nov. 3 for constructing sewers in E. 44th and E. 124th sts. and Wheelock road. W. J. Springborn, prest. B. P. S.

Fort D. A. Russell, Wyo.—Bids are asked until Nov. 5 for constructing an independent outlet sewer for a sewer system here. Capt. V. K. Hart, acting Q. M.

McKeesport, O.—Bids are asked until Nov. 4 for a complete design of a sewerage system and sewage disposal plant, with estimate, cost, etc. C. E. Soles, cy. compt.

Providence, R. I.—Sealed bids are asked until Nov. 9 for constructing 5,620-lin. ft. of 30-in. brick and concrete sewer. Henry Fletcher, mayor and chmn. bd. contr. and sup.

Brooklyn, N. Y.—Bids are asked until Nov. 10 for constructing sewers in a number of streets. Bird S. Coler, prest. boro.

CONTRACTS AWARDED.

London, O.—William F. Mannagan was awarded the contract, Oct. 13, for constructing 2 sewers, for $6,932.

Sandborn, Ind.—The contract for constructing a drainage system was awarded to Robert L. Clodfelter, for $1,675.

Boone, Ia.—The contract for constructing sewer work was awarded to A. T. Gary, of Denison, Ia., for $55,000.

West Allis, Wis.—The contract for constructing 10-mis. of sewers was awarded, Oct. 11, to Green Sons' Co., of Chicago, for $60,991.

La Crosse, Wis.—Jos. M. Lapitz was awarded the contract for constructing a sewer in N. 11th and other streets, for $3,801.

Eldorado, Ark.—The contract for constructing a sewerage system was awarded to the J. H. Mellor Hardware Co., for about $30,000.

Indianola, Ia.—Smith & Son secured the contract for constructing 3,000-ft. of 6 to 12-in. sanitary sewers, Oct. 4, for $3,397.

Hamilton, Mont.—The Burrill Bridge & Construction Co. was awarded the contract for constructing a sewerage system, Oct. 4, for $13,470.

Indianola, Ia.—Smith & Son secured the contract for constructing the first installment of the proposed sewerage system, for $3,596.58.

Newton, Kas.—The contract for constructing 13-mis. of sewers and a septic tank was awarded to Hamilton Bros., of Chicago, for $34,973.80.

Norristown, Pa.—John Skelly & Son secured the contract for building a sanitary sewer in Cherry st. at 69 cts. a lin. ft. and $90 each for flush tanks.

Batavia, N. Y.—The contract for constructing a sewerage system was awarded, Oct. 11, to the Thomas Sweeney Co., of Pittsburg, Pa., for $252,703.27.

Tacoma, Wash.—The contract for extending the W. 6th st. sewer outfall, and a sanitary sewer in an alley, was awarded to W. A. Jones, for $27,777.

San Francisco, Cal.—Peter McHugh was awarded a contract, Oct. 21, for constructing a sewer in 14th st. with laterals in adjacent streets, for $38,971.48.

Dayton, O.—The contract for constructing storm sewers in Costello, Hartford and adjacent streets was awarded to R. E. Vanderbark, of Zanesville, O., for $3,255.

Heber, Ark.—The contract for constructing a sewerage system was awarded to Mellor, Lucowitz & Shull. The system will consist of 5-mis. of sewer mains and 4 large septic tanks.

York, Pa.—Sewer contracts have been awarded as follows: W. New York ave., Garrety Bros., $1,385.51; W. Poplar, $75.04, W. Princess, $575.64, and E. Market st., $272.38, General Supply & Construction Co.

Cincinnati, O.—Thomas Maloney was awarded the contract for constructing a sewer in the ravine west of Torrence road, Madison road and other streets in that vicinity, Oct. 14, for $25,967, which price is $6,000 lower than the estimated cost.

Clarinda, Ia.—Sewer contracts have been awarded as follows: Sewer outlet, Dunnegan & Corey, of Shenandoah, 84 cts. a lin. ft.; sewers in Clark and Logan sts., 59 cts., and State st., 52 cts. a lin. ft., Independent Construction Co., of Davenport.

Barrie, Ont.—The contract for constructing the outfall works, including sedimentation tanks, sludge beds, etc., for wards 5 and 6 (Allandale) sewerage system, now under course of construction, was awarded to A. C. Stewart & Co., of Winnipeg, Man., for $14,500.

Fargo, N. D.—The contract for constructing 3 sewers was awarded to C. W. Schruth, as follows: Trunk sewer in 9th ave., $1.55 a lin. ft., $58 each for catchbasins, and $58 each for manholes; sewer in College and 14th sts., $1.07 a lin. ft., $51 each for catchbasins, and $58 for manholes.

Louisville, Ky.—Contracts for constructing certain sections of the new sewerage system for this city were awarded, Oct. 12, as follows: Sections D. I and C of northwestern sewer, James Duff Construction Co., of Cleveland, O., $250,000; section B of same sewer, Charles F. Fitch Co., $80,000; section D, E. A. Barker & Son, $80,000.

Lincoln, Neb.—The contract for extending the concrete waterway between N and P sts., a distance of about 800-ft., was awarded, Oct. 4, to the Lincoln Construction Co., as follows: Excavation, 49 cts. per yd.; concrete work, reinforced, $10.93 per cu. yd.; paving, $1.75 per sq. yd.; total,

$37,638. Other bidders were: John Schrank, $50,502; C. D. Campbell, $39,900; Marsh-Burke Co., $39,824.

Boston, Mass.—The West Roxbury Trap Rock Co. was awarded the contract for constructing a sewer in Hyde Park ave., West Roxbury, for $13,227. The contract for building sewers in Farquhar st. and an outlet between Robert and South sts., West Roxbury, was awarded to A. Cefalo, for $6,636. Peter W. Hill was awarded a contract, Oct. 6, for constructing a concrete sewer in Porter st., East Boston, for $14,000.

WATER WORKS.

Vinalhaven, N. J.—The Vinalhaven Water Co. has been incorporated by T. E. Libby, C. N. Taylor and C. S. Libby.

Washington, D. C.—George W. Wallace, water registrar, submitted a report, Oct. 20, stating that by the installation of water meters in thousands of private residences in the District during the last year millions of gallons of water have been saved.

Knoxville, Tenn.—The municipal ownership plan of the water works system, decided upon by this city after the recent U. S. supreme court decision, provided for the city's payment of $643,700 in cash, assuming bonds to the amount of $639,700, and also assuming liability of $24,000 for any judgments that water consumers may secure in the courts by reason of excess water charges made by Knoxville Water Co. while litigation involving a schedule of rates made by the city council was on.

CONTEMPLATED WORK.

Mediapolis, Ia.—Voted to establish water works.

Seymour, Ia.—Voted to issue bonds for constructing a water works system.

Martinsville, Va.—Voted to issue $35,000 bonds for water works improvements.

Woodward, Okla.—Voted to issue bonds for the extension of the water works system.

Holdingford, Minn.—Voted to issue bonds for constructing a water works system.

Athens, Tex.—Voted to issue $30,000 bonds for constructing a water works system.

Ackerman, Miss.—Voted to issue bonds for constructing water works and electric light systems.

Milford, Ia.—This town voted to issue $12,000 bonds for constructing a water works system.

Sisseton, S. D.—(Special.)—Thomas W. Cahill advises us that he desires to purchase water meters.

Murray, Utah—The construction of a water works, sewer and electric light system is contemplated.

Calumet, Minn.—Plans for a system of water works for this city are being made by the Duluth Engineering Co., of Duluth.

Crestline, O.—Council has passed an ordinance providing for the issue of $6,000 bonds for enlarging the pumping station.

Erie, Kas.—Plans have been prepared and a bond election will be held Nov. 2 for constructing a water works system.

Juniata, Pa.—A. C. Sorrick, chief burgess, has signed the ordinance providing for the further completion of the borough water system.

Osceola, Ia.—This city contemplates rebuilding the reservoir dam and making improvements. Chas. P. Chase, cons. engr., Clinton, Ia.

Providence, R. I.—Plans and specifications for 6 centrifugal pumps to be installed at the Ernest st. sewage pumping station were submitted to the board of contract and supply, Oct. 14, and bids will be asked soon for the system.

Macon, Ga.—A special report to the city council places the estimate of a new water works system in this city at about $900,000.

Vancouver, B. C.—Plans have been prepared for supplying several adjoining municipalities with water. Initial cost, $500,000.

Ash Grove, Mo.—(Special)—J. H. Turk advises us that this city expects to construct a water works and electric light system in the future.

Lamar, Colo.—(Special)—C. T. Wilson, cy. engr., says this city's water franchise will expire in April, 1910. The city will consider bids.

Denver, Colo.—The Trades and Labor Assembly recommended, Oct. 11, that amendments to the city charter be made providing for securing a municipal water plant.

Collinwood, O.—Will vote Nov. 2 on the question of issuing $15,000 bonds for water works improvements, including additional mains, pipes and hydrants.

Weston, Ore.—The improvement of the water works system by installing new pipe and building new dams and reservoirs is contemplated. T. S. McKinney, cy. recdr.

Auburn, N. Y.—Plans are being prepared for a filtration plant, pure water reservoir and alterations to pumping station. Estimated cost, $170,000. J. W. Ackerman, supt.

Victoria, B. C.—Plans have been presented by Arthur L. Adams, civic water expert, for supplying the city with water from Sooke Lake at a cost of $2,236,500 or $1,663,000.

Ardmore, Okla.—Mayor J. A. Cotner and other city officials visited Dallas, Tex., Oct. 8, for the purpose of studying plans for the enlargement and improvement of the water works system in this city.

CONTRACTS TO BE LET.

Belden, Neb.—Bids are asked until Nov. 4 for constructing a water-works system. Vil. clk.

White Plains, N. Y.—Bids are asked until Nov. 8 for constructing an intercepting wall. Bd. water comrs.

Benoit, Wis.—Bids are asked until Nov. 2 for drilling an artesian well. M. M. Thompson, mayor.

Ft Dade, Fla.—Bids are asked until Nov. 9 for extending the water mains 3,500 ft. Constru. Q. M.

Kansas City, Kas.—Sealed bids are asked until Nov. 5 for furnishing 200 fire hydrants. C. S. Holbrook, mayor and purchasing agt.

Titusville, Pa.—Bids are asked until Nov. 4 for furnishing 1,500 ft. of 6-in. water pipe, a 3-way fire hydrant, etc. Water & lght. comr.

Ackerman, Miss.—Sealed bids are asked until Nov. 2 for constructing a waterworks and electric light plant. J. M. Harris, cy. clk.

Key West, Fla.—Bids are asked until Nov. 6 for constructing a concrete cistern at U. S. Naval Station here. Bureau Yds. & Docks, Navy Dept., Washington, D. C.

Detroit, Mich.—Bids are asked until Nov. 9 for 3 pumping engines for the new pumping station. Bejamin F. Guiney, secy. bd. water comrs.

Cincinnati, O.—Sealed bids are asked until Nov. 15 for installing a water system at Dam No. 37, Ohio river. Lieut.-Col. J. G. Warren.

Urbana, O.—Sealed bids are asked until Nov. 20 for constructing 269,489 cu. yds. of dredge work. C. D. Russel, audt.; James Swisher, Co. surv.

Pleasant Ridge, O.—Bids are asked until Nov. 10 for furnishing and laying 4-in. water pipe in Burgoyne ave. and 5-in. water pipe in Robinson road. H. B. Hayden, vil. clk.

Dallas, Tex.—Bids are asked until Nov. 10 for furnishing and installing a 14,000,000-gal. pumping engine of vertical triple expansion type. J. B. Winslett, cy, secy.

Indian Head, Md.—Bids are asked until Nov. 6 for an additional artesian water supply and connections at the naval proving ground here. Bureau Yds. & Docks, Navy Dept., Washington, D. C.

New York City—Sealed bids are asked until Nov. 4 for installing a new Croton pressure system, new salt water line, etc. John J. Barry, comr. correction, Manhattan boro.

Spokane, Wash.—Bids are asked until Nov. 5 for furnishing 37,500,000-gal. multistage centrifugal pumps and 3 induction motors, switchboard and connections. Geo. W. Armstrong, secy. B. P. W.

Ft. Hancock, N. J.—Bids are asked until Nov. 19 for constructing a pump house, coal trestle, boilers, machinery, piping, etc., 8-in. well, extension of water mains, etc. C. J. Goodwin, constr. Q. M.

Breckenridge, Minn.—Bids are asked until Nov. 5 for machinery, electrical equipment, piping, tank and tower and brick buildings of the mechanical filtration plant and system. F. L. Pearce, secy. Water & lgt. comm.

Dumas, Ark.—Sealed bids are asked until Nov. 10 for constructing a water works system, requiring a 6-in. deep well; 4,000-ft. 2-in. pipe; 6,000-ft. 4-in. pipe; 1½-ton specials; pumphouse, pumps, valves, fittings, etc. I. N. Moore, secy.

Philadelphia, Pa.—Bids are asked until Nov. 4 for converting Queen Lane pumping station into a filtration plant, and equipping with 2 pumps for sand washing, 2 centrifugal pumps for washing filter beds, 2 electric light generators, 4 boilers, coal-handling plant with traveling crane, etc. Dept. pub. wks.

Guyama, P. R.—Bids are asked until Jan. 17 for constructing an earth and gravel dam, to be known as the Patillas Dam, and appurtenant structures, near Patillas, requiring about 726,000-cu. meters of earth, rock and gravel, and placing about 2,900-cu. meters of concrete. Porto Rico Irrigation Service, B. M. Hall, ch. engr.

CONTRACTS AWARDED.

Barberton, O.—The contract for constructing water main extensions was awarded to Paul & Henry.

Denver, Colo.—The contract for constructing a retaining wall at Berkeley Park Bluffs was awarded to John B. Highes, for $7,799.

Eagle River, Wis.—The contract for constructing new water mains was awarded to W. C. Fraser, of Rochester, Minn., for $9,500.

Painted Post, N. Y.—The contract for constructing the reservoir and pumping station for the new water works system, was let for $6,228.

Park Falls, Wis.—The contract for installing a water works system was awarded to Greene Bros., of Albert Lea, Minn., for about $10,000.

Twin Bridges, Mont.—The contract for constructing a concrete reservoir in Goodrich, was awarded to the American Gold Fields Co., for $15,000.

Valley, Neb.—The contract for constructing a water works and electric light plant here was awarded to the National Company, of South Bend, Ind.

Forest Grove, Ore.—The contract for constructing a new gravity water works system was awarded to the Western Water Pipe Co., of Portland, Ore., for $21,536.

Seattle, Wash.—The contract for constructing 20-mis. of water mains in West Seattle was awarded to the Jahn Construction Co., at a cost of $300,000 to $400,000.

Bradford, Ill.—The contract for constructing water mains in W. Main and N. Peoria sts. and Douglas ave. was awarded to Henry Marlow, of Kewanee, for $1,831.70.

Ft. Leavenworth, Kas.—The contract for the replacement of water mains to the quartermaster's stables and adjacent buildings, and for better fire protection of buildings in that vicinity was let for $3,948.

Sioux Falls, S. D.—The contract for constructing a reinforced concrete well and motor house for the municipal water works system was awarded to the Security Bridge Co., of Minneapolis, Minn., for $5,477.

Denver, Colo.—The contract for the enlargement of Marshall Lake, part of the Stanley Lake irrigation system, northwest of this city, was awarded to the Phillips & O'Gara Construction Co., for about $150,000.

New Britain, Conn.—The contract for constructing 8,000-ft. of 16 to 20-in. pipe and for installing standpipes in the northwest section of this city, was awarded to R. D. Wood & Co., 400 Chestnut st., Philadelphia.

New York City—The contract for installing 2 12,500,000-gal. steam turbine pumps, 2 225-h. p. water tube boilers and all accessories was awarded to the Lord Electric Co., 214 W. 40th st., New York City, for $34,884.

Newark, O.—Contracts for supplies necessary in the extension of the municipal water works system have been awarded as follows: Furnishing 735-tons of 6 and 8-in. pipe, Clow & Sons, of Chicago; hydrants, R. D. Wood & Co., Philadelphia; gate valves, Rensselaer Co., of Chicago.

Kensington, Kas.—The contract for constructing the water works was awarded to T. C. Brooks & Sons Co., of Jackson, Mich., Oct. 6, as follows: Engine and pump, $1,840; 6, 4 and 2-in. pipe, 81 cts. to 27 cts. per ft.; tank and tower, $4,685, etc.

Freeburg, Ill.—The contract for the improvement and extension of the water works system was awarded to Howard H. Hill, Sexton Bldg., East St. Louis, Ill., Oct. 4, as follows: Steel tank and tower, $4,275; 840-ft. 8-in. c.-i. pipe, including specials, 95 cts., and 1,760-ft. 4-in. c.-i. pipe, 61 cts.; five 2-way hydrants, $24.90, and 150-ft. old 4-in. pipe taken up, 15 cts. Total, $6,294.

BRIDGES.

Eaton, O.—Bids are asked until Nov. 6 for constructing 4 new bridges. Co. comrs.

Oreapolis, Neb.—The construction of a wagon bridge across Platte river is contemplated.

Knoxville, Tenn.—Bids are asked until Nov. 8 for constructing the Asylum ave. viaduct. B. P. W.

New Orleans, La.—Council has adopted an ordinance to construct a bridge across the New Basin at Galvez st.

La Moure, N. D.—Bids are asked until Nov. 16 for constructing various bridges. C. J. Alister, co. audt.

Rushville, Ind.—Bids are asked until Nov. 3 for constructing bridges and arches. Jesse M. Stone, co. audt.

Philadelphia, Pa.—Mayor Reyburn advocates the construction of a bridge across the Reading Ry. at Westmoreland ave.

Covington, Ind.—Bids are asked until

Nov. 2 for constructing concrete wings to a bridge in Ruchland twp. W. B. Gray, co. audt.

Decatur, Ind.—Bids are asked until Nov. 2 for constructing the Luginbill bridge, in Blue Creek twp. Martin Laughlin, chmn. co. comrs.

Cincinnati, O.—Bids are asked until Nov. 19 for constructing a concrete bridge on the Compton road. Stanley Struble, prest. co. comers.

Vincennes, Ind.—Bids are asked until Nov. 2 for erecting a steel bridge on concrete abutments across Black creek. John T. Scott, co. audt.

Phœnix, Ariz.—Sealed bids are asked until Nov. 6 for constructing a bridge over Salt river, at the foot of Center st. Wm. E. Thomas, clk. bd. supvrs.

Vancouver, B. C.—Bids are asked until Nov. 12 (extension of date from Oct. 25) for building a bridge over False creek, between Bridge and Beatty sts. Mayor and coun.

Tallulah, La.—Bids are asked until Nov. 3 for erecting a bridge over Roundaway bayou, near the "Briars plantation." A. L. Slack, secy. police jury, Madison Parish.

Des Moines, Ia.—The city council has adopted a resolution directing the city engineer to prepare plans for a concrete bridge over the Des Moines river at Walnut st.

Reading, Pa.—Bids are asked until Nov. 4 for erecting a steel truss bridge, with concrete floor and macadam roadway, over Tulpehocken creek. A. L. Rhoads, co. compt.

Cincinnati, O.—Bids are asked until Nov. 19 for constructing a bridge superstructure over South Fork Taylor's creek, at foot of Kerper road, Green twp. Stanley Struble, prest. co. comrs.

Cleveland, O.—Bids are asked until Nov. 16 for constructing a bridge substructure over the tracks of the N. Y. C. & St. L. Ry., and raising the bridge over Walworth Run to the new grade. The work will include about 2,400-yds. reinforced concrete, 4,000-yds. plain concrete, 600-yds. stone masonry and 14,000-ft. piling. W. J. Springborn, prest. B. P. S.

STREET LIGHTING.

Wewokam, Okla.—Voted to issue bonds for installing an electric light system.

Bridgeton, N. J.—Bids are asked until Nov. 2 for lighting the city for 5-yrs. Frank L. Hewitt, cy. clk.

Ash Grove, Mr.—(Special)—J. H. Turk says this city expects to construct an electric light plant soon.

Ft. Dupont, Del.—Bids are asked until Nov. 9 for erecting an electrical lighting system here. Constr. Q. M.

Dayton, O.—City council has approved a report recommending the installation of a boulevard lighting system.

Orange, N. J.—Bids are asked until Nov. 8 for constructing a municipal lighting plant. Arthur B. Seymour, mayor.

Richmond, Va.—Bids are asked until Nov. 8 for condensers, pumps and heaters for the city lighting plant. E. D. Richardson, chmn. com. electricity.

Spokane, Wash.—Bids are asked until Nov. 5 for furnishing 3 centrifugal pumps, 3 induction motors, switchboard, etc. Geo. W. Armstrong, secy. B. P. W.

Zanesville, O.—The Twin City Light & Fuel Co. has been incorporated by C. Lou Wright, E. M. Armstrong, A. C. Armstrong, J. R. Greiner and Charles Graves.

New London, Conn.—Bids are asked until Nov. 8 for installing electric lighting fixtures and wattmeters in 10 buildings at Ft. H. G. Wright, constr. Q. M.

Globe, Ariz.—The Arizona & Eastern Consolidated Mining Co. contemplates the construction of a hydro-electric plant to furnish electricity for operating its properties.

Lamar, Colo.—(Special)—C. T. Wilson, cy. engr., says this city's electric light franchise will expire in January, 1910, and that the city will consider bids.

Savannah, Ga.—Bids are asked until Nov. 8 for illumination by 610 electric arcs, and also by incandescent lamps, and for sale to city of electric current for illumination, heat or power. Harry Willick, dir. pub. wks.

Roslyn, N. Y.—The public service comn. has approved the consolidation of the Nassau Light & Power Co., the Nassau Gas, Heat & Power Co., the Floral Park Light & Power Co. of Roslyn, and the Oyster Bay Electric Light & Power Co., of Oyster Bay.

Baltimore, Md.—The American Street Lighting Co. has been awarded a contract as follows: $10.10 each for maintaining 7,312 gas lamps, and $26 each for supplying the naphtha and maintaining 1,030 naphtha lamps for the year beginning March 10, 1910.

Clinton, N. Y.—The contract for furnishing electricity for operating the municipal light system was awarded to Chas. A. Borst, of the Clinton Hematite Ore Mines, for 5-yrs. as follows: Electricity for 27 arc lamps at $35 each per year; 20 incandescent street lamps of 32 c. p., at $15 per lamp per year, and electrical energy for commercial and residential lighting at 8 cts. per kw. hr. Mr. Borst will install a plant at once at his mines, so as to be ready to furnish electrical energy when the present contract expires next February. The village owns the distributing system.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Akron, O.—The question of constructing a sewage and garbage disposal plant is being considered, and an ordinance has been passed providing $1,000 bonds for securig plans. Estimated cost, $600,000.

Ft. Thomas, Ky.—The contract for constructing a garbage crematory was awarded to the Morse-Boulger Destruction Co., of New York City, for $2,175, and the contract for the building to Jos. G. Herrmann, of Newport, Ky., for $1,334.

PARKS.

Watertown, Wis.—A park tract on Rock river will be presented to this city by Chas. L. Kiewert, of Milwaukee.

Gary, Ind.—An ordinance has been passed providing for the acquirement, by condemnation, of a 90-acre park on the lake front.

Stillwater, Minn.—The city council and the Boosters' Club have engaged W. A. Finkelnburg, landscape artist of Winona, Minn., to prepare plans for adorning the levee park.

FIRE APPARATUS.

Sisseton, S. D.—(Special)—Thos. W. Cagill advises us that he desires to purchase a hose cart and hose.